

EXHIBIT G

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field from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI-301, Section 3.8.

- D. When, in the opinion of the Engineer, conditions of the work or weather justify, forms may be required to remain in place for longer periods.

3.9 RECORD OF PLACINGS AND FORM REMOVAL

- A. An accurate record shall be maintained of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall be available for inspection at all times on the job, and two copies shall be furnished to the Engineer upon completion of the concrete work.

3.10 QUALITY OF CONCRETE WORK

- A. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
- B. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
- C. Cut out and properly replace to the extent ordered by the Engineer, or repair to the satisfaction of the Engineer, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
- D. All leaks through concrete, and cracks, holes or other defective concrete shall be repaired and made watertight by the Contractor.
- E. Repair, removal, and replacement of defective concrete as ordered by the Engineer shall be at no additional cost to the Owner.
- F. Tolerances and criteria delineated in ACI 301 shall be strictly adhered to.

3.11 ADMIXTURES

- A. When directed or approved by the Engineer, an admixture shall be added to the concrete to control the rate of

hardening and workability. Admixture shall be of the retardant type under high temperatures and the accelerating type under low temperatures. The admixture shall be added to the mix at the batch plant and the proportions shall be in strict accordance with the manufacturer's recommendations.

- B. Concrete retardant shall be used to expose aggregate and to provide the concrete with rough bonding surfaces at all horizontal construction joints. Apply retardant on forms or spray on unformed horizontal construction joints in strict accordance with manufacturer's directions. Remove all unset mortar by wire brushing or with a water jet within the time limit specified by the manufacturer. In lieu of the above method of exposing aggregate, a water blast or sand blast method may be used for vertical and horizontal surfaces. The Contractor must satisfactorily demonstrate, on sample Panels, that the proposed method can achieve an etch of 1/8-inch, minimum.
- C. Use air entraining admixture in all concrete, except interior slabs subject to abrasion, unless otherwise shown or specified. Add air entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.

3.12 CONSTRUCTION AND EXPANSION JOINTS

- A. Construction and expansion joints shall be located as shown on the Contract Drawings where structural integrity is affected. Otherwise, Contractor shall submit description of the joint and its location to Engineer for approval.
 - 1. Additional construction joints shall be located as follows: (except where otherwise noted on drawings):
 - a. In walls locate joints at a spacing of approximately 40 feet.
 - b. All corners shall be part of a continuous pour, and should a construction joint be required, the joint shall not be located closer than 12 feet from a corner.

- c. In foundation slabs and slabs on grade locate joints at a spacing of 40 feet maximum. Place concrete in a checkerboard pattern.
 - d. In mats and structural slabs and beams, locate joints in compliance with ACI 301, Chapter 6 and recommendations of ACI 350, at a spacing of 40 feet maximum.
 - e. Provide other additional construction joints as required to satisfactorily complete all Work.
- B. In general, joints shall be located near the middle of the spans of slabs. Joints in walls shall be at the underside of floors, slabs, and the top of footings or floor slabs, unless otherwise indicated on the Contract Drawing. Joints shall be perpendicular to the main reinforcement.
- C. All reinforcing steel and welded wire fabric shall be continued across joints. Keys and inclined dowels shall be provided as shown on the Contract Drawings or as directed by the Engineer. Longitudinal keys at least 1-1/2 inches deep shall be provided in all joints in walls and between walls and slabs or footings, except as specifically noted otherwise on the Contract Drawings.
- D. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed by wire brushing, air or light sand blasting. On horizontal joints where concrete is to be placed on hardened concrete, a slush coat of mortar 1/2 inch to 1 inch thick with slump less than 6 inches, made of the same materials as the concrete, but, without the coarse aggregate, shall be worked well into the irregularities of the hard surface just ahead of the concrete pour.

3.13 SLABS ON GROUND

- A. The subgrade for slabs on ground shall be well drained and of adequate and uniform load bearing nature. The in-place density of the subgrade soils shall be at least the minimum required in the specifications. The bottom of an undrained granular base course shall not be lower than the adjacent finished grade.

- B. The subgrade shall be free of frost before concrete placing begins. If the temperature inside a building where concrete is to be placed is below freezing it shall be raised and maintained above 50°F long enough to remove all frost from the subgrade.
- C. The subgrade shall be moist at the time of concreting. If necessary, it shall be dampened with water in advance of concreting, but there shall be no free water standing on the subgrade nor any muddy or soft spots when the concrete is placed.
- D. Provide control joints in slabs-on-grade at locations indicated on the drawings. Control joints may be construction joints or sawed joints (cut 1/4 of the slab depth). Saw cuts for control joints shall be performed within 24 hours after the concrete is placed. For floors receiving floor coverings, joints may be made by insertion of fiberboard strips (1/4 of the slab depth) into the unset concrete. Wire mesh or reinforcement shall be interrupted 2 inches clear each side of sawed or impressed control joints.
- E. Floor slabs shall be screeded level or pitched to drain as indicated on the Drawings. Slabs to be finished as specified in Item 3.14 hereinafter.

3.14 CONCRETE FINISH

- A. Unless otherwise called for or shown on the Contract Drawings all exposed edges shall have a 3/4 inch chamfer.
- B. Concrete surfaces that are not exposed in the completed work will require no special finish other than such pointing up as is necessary to leave them smooth and impervious. All openings left by the removal of form ties shall be pointed up carefully with mortar. All concrete surfaces that are exposed in the completed work to the atmosphere or to water shall be finished as specified herein. Immediately after removal of forms, finishes as hereinafter specified shall be applied.

1. Formed Vertical Faces:

- a. All exposed vertical faces of formed concrete shall be prepared for the specified finish as follows. Remove all forms in such manner as to prevent damage to the concrete and at the proper time for the required finish.
- b. Point up all areas, remove any projections and fins, repair all honeycomb as permitted and approved by the Engineer, and fill in all tie holes. Mortar used for filling and repairs shall be of the proper consistency and of the same color as the adjacent concrete. Any pointing up and repair not consistent with these specifications or approved by the Engineer shall be redone at no extra cost to the Owner.
- c. A grout finish shall be used on the interior walls of the clearwell, all exposed exterior and interior vertical and formed faces of concrete, unless otherwise noted or specified.
- d. The grout finish on walls shall be carried at least 12 inches below finished grade or to the floor slab in case of interior wall faces.
- e. After the pointing has been sufficiently set to permit it, the grout finish shall be applied in the following manner: The concrete surface shall be thoroughly moistened (but not soaked and no free water shall be standing) and the entire surface painted with a sand-cement wash. The wash shall be composed of one part of Portland cement, of which portion approximately 33 percent shall be White Portland cement, and 1 to 1 1/2 parts fine clean sand passing a No. 30 sieve. The grout shall be of such consistency that it will not run when applied to vertical surfaces, and so that it will fill all voids in the surface of the concrete. The sand-cement wash shall be applied with a brush and thoroughly worked into the concrete at a rate

that will completely fill all voids in the surface of the concrete and provide a firm even texture uniform in color. After the wash has started to harden slightly, but before it has taken its initial set, any excess material shall be removed with a straight edge, and in about an hour, the surface shall be rubbed with a rough cloth or pad to remove the excess wash entirely from the surface and leave the voids filled. The wash shall be applied without a break in application (time lapse sufficient to allow wash to set up) in any wall, beam or column face except at corners, edges or other offsets. Prior to final approval of the work, any surface which has been disfigured by drippings or other causes shall be thoroughly cleaned, using a weak solution of muriatic acid, if necessary, and grout finish application repeated as required. The entire grout finish operation shall be accomplished using a single brand of Portland cement and a single source of sand throughout the Project.

2. Unformed Horizontal Surfaces:

- a. All exterior horizontal concrete surfaces shall be screeded and then worked to a true, smooth surface with wood floats and proper edging or jointing tools.
- b. All interior concrete floors and slabs shall receive a swirl finish.
- c. Provide smooth form finish for all interior and exterior exposed beams and undersides of slabs.
- d. Floors shall have the aggregate well worked down from the surface and be given a hard, smooth steel trowel finish. After the hard, smooth finish is obtained, the finisher shall make an additional pass over the surface to obtain a nonskid finish, commonly known as a "swirl finish" which is smoother than "sidewalk finish" but is not of a glass like smoothness.

- e. Dusting with sand or cement will not be permitted.
- f. Paint, silicone damp-proofing or other coatings or substances shall not be applied to surfaces or adjoining joint surfaces until sealants have been installed and are nominally cured.
- g. Concrete and Masonry Joint Surfaces: Etch bonding surfaces with a 5 percent solution of muriatic acid, rinse thoroughly with water, and dry.

3.15 CUTTING AND PATCHING

- A. Where concrete areas are to be patched, the perimeter of the area is to be saw cut, and all deteriorated concrete is to be removed to a minimum depth of at least 3/4 inch behind the exposed reinforcing. The perimeter of the saw cut area shall be under cut all around. Any exposed reinforcing shall be spliced by lap welding where more than 25% of the cross sectional area of the rebar is lost. The exposed concrete and reinforcing shall then be sandblasted. The concrete surface now exposed shall be moistened and exposed reinforcing shall be cured with an anticorrosion, cementitious coating, (Sikatox 108 or approved equal). The saw cut area shall be filled to match the level of the existing surface with repair mortar (Sikatox 122 or approved equal) and cured with a membrane covering.

3.16 EQUIPMENT FOUNDATIONS

- A. All equipment pads and foundations not otherwise noted on the drawings or in this specification shall be formed, reinforced and poured to the dimensions shown. All exposed surfaces except those surfaces subsequently required to receive grout and support equipment bases shall, unless otherwise noted elsewhere in the project specification, be finished as detailed in ACI 301, Chapter 10, to a "smooth form finish." Exterior angles shall be chamfered. Contractor shall build in all anchor bolts, sleeves and other built-in fittings as required for the equipment. Surfaces which will later receive grout shall, before the concrete takes its

final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with indentations in the surface of 1/2 inch and irregular.

3.17 GROUT

A. Applications:

1. Type A - Nonshrink Grout Mix A - Nonshrink Grout shall be used for the setting of structural items such as base plates for columns and beams, equipment and other machinery. All grout shall be mixed and placed in strict accordance with the directions of the manufacturer.
2. Type B - Nonshrink, Epoxy Grout Mix B - Nonshrink, Epoxy Grout shall be used for sloping floors (prior to installing Heavy Duty Floor Toppings), the setting of handrail Posts, and around new openings, reinforcing bar dowels into existing concrete, piping, and plain opening in existing walls or where indicated on the Contract Drawing. All grout shall be mixed and placed in strict accordance with the directions of the manufacturer.

B. Preparation:

1. The underside of the base plate for columns and beams, equipment and other machinery shall be cleaned of all dirt, grease and oil-like films.
2. The pertinent concrete surfaces shall likewise be cleaned of all similar contamination and debris, chipping or roughening the surface if any laitance or poor concrete is in evidence. Special care shall be taken with the grout in hot or cold weather to insure proper setting and gain of strength. Aggravating conditions of placement are to be alleviated to an extent that the temperature of the grout up until time of set will be about the range of 60° to 80°F. Ice or hot water may be used and shields from the sun and hot winds shall be provided when required. Following cleaning, the concrete shall be water saturated for a period of

6 hours, the excess water then removed from the surface and nonabsorbent edge forms erected.

C. Grouting:

1. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. Whenever Practical, grout shall be poured from one side only and thence flow across to the open side to avoid air entrapment.

D. Finishing:

1. If an expanding grouting aid is used, the recommendations of the manufacturer on finishing of exposed edges shall be strictly followed. All visible wedges shall be removed 48 or more hours after the grout has been placed.

3.18 CONCRETE THRUST BLOCKS/SUPPORTS

- A. General: The Contractor shall provide, poured concrete thrust blocks and supports at all changes in direction and as shown on the Drawings. Concrete thrust blocks and support piers shall be poured between solid ground and the fitting to be supported. The thrust blocks shall conform to the dimensions shown on the Contract Drawings or as approved by the Engineer and shall be so placed that pipe and fitting will be accessible for repair.

+ + END OF SECTION + +

SECTION 03310

CONCRETE CLEARWELL REPAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: This Section provides the minimal workmanship requirements for the surface preparation and repairs to the interior concrete clearwell surfaces.

B. Related Work Specified Elsewhere:

1. Section 03300, Cast-in-Place Concrete.

1.2 REFERENCES

The latest edition of the following standards and regulations form a part of this specification as applicable to the scope of work:

A. American Society for Testing and Materials (ASTM):

1. ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air.
2. ASTM D4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
3. ASTM D 6237, Standard Guide for Painting Inspectors (Concrete and Masonry Substrates).

B. American Water Works Association

1. AWWA D102-97, AWWA Standard for Painting Steel Water-Storage Tanks
2. AWWA C652-92, AWWA Standard for Disinfection of Water-Storage Facilities

C. Steel Structures Painting Council (SSPC)

1. Guide 6, Guide for Containing Debris Generated During Paint Removal Operations

2. SSPC-SP 1, Solvent Cleaning
3. SSPC-SP 2, Hand Tool Cleaning
4. SSPC-SP 3, Power Tool Cleaning
5. SSPC-SP 6, Commercial Blast Cleaning
6. SSPC-SP 10, Near-White Metal Blast Cleaning
7. SSPC-SP 11, Power Tool Cleaning to Bare Metal
8. SSPC-VIS 1, Visual Standard for Abrasive Blast Cleaned Steel

D. Equipment and Coating Manufacturers' Published Instructions

1.3 DESIGN REQUIREMENTS

All materials, design and workmanship shall conform to the Standard Specification for Steel Water Tanks, Standpipes and Reservoirs of the American Water Works Association (AWWAD-100/latest), including Appendix C, except as noted below.

1.4 SUBMITTALS

- A. Manufacturer's technical information for all materials purchased.
- B. Manufacturer's technical information for concrete repair material.

1.5 STRUCTURAL AND PERFORMANCE GUARANTEES

- A. Contractor shall guarantee that the tanks shall remain watertight at the completion of all repairs and improvements.
- B. Any workmanship or material that may prove to be defective within two (2) years from the date of completion shall be repaired or replaced by the Contractor without expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials specified are those which have been evaluated for the specific service. Manufacturers listed are representative of a standard of acceptable quality. Substitute products may be acceptable if proper documentation is submitted for Engineer review. All coating systems shall meet the requirements of the American Water Works Association and shall be certified by the National Sanitation Foundation for contact with potable water (NSF Standard 61). All other requirements of other sections relating to product delivery and use are applicable.

2.2 CONCRETE REPAIRS

- A. All spalled, chipped or honeycombed concrete shall be repaired using approved products. Scope of work includes all clearwell interior surfaces. All concrete surfaces must be sound, dry and clean. Remove all broken and spalled concrete, dirt, rust, scale, oil, grease, coatings or other foreign matter by chipping, grinding and abrasive blasting as required. Epoxy repair materials shall be mixed in strict accordance with manufacturer's recommendations. Crack filler shall be applied liberally over cracks by brush and allowed to flow into cracks. Reapply to the top of the cracks after settlement. Epoxy patch materials shall be applied using troughs, knife edges or screens. Press material uniformly into place to fill voids then finish with standard finishing tools.

B. Materials

The following materials shall be used for concrete crack, honeycombing and spalling repairs:

1. Carboline: Carboguard 501
2. Tnemec: 63-1500 Filler and Surfacer
3. Sherwin-Williams:
 - a) Cracks: Corobond Crack Filler (TRM.70)

- b) Concrete repairs less than 1/4 -inch thick:
Steel-Seam FT910 (TRM.67)
- c) Concrete repairs greater than ¼-inch thick:
Cor-Cote Epoxy Polymer Concrete (TRM.21)

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall take all necessary measures to protect all of the existing facilities from collection of dust or other damage during performance of the work. All equipment, piping, instrumentation, floors and walls shall be covered with tarps and/or drop cloths prior to commencing the work.

3.2 ACCEPTABLE APPLICATORS

- B. Repair mortar applicators shall be trained to properly apply the cementitious mortar according to manufacturer's recommendations.
- C. Protective coating must be applied by a Certified Applicator of the protective coating manufacturer and according to manufacturer specifications.

3.3 INSPECTION OF CONDITIONS

- A. Prior to commencing work, inspect all surfaces to verify the suitability of the surfaces to be prepared and to receive repairs. Report to the Owner, in writing, any condition that may affect proper surface preparation, application or overall performance of the repair or roofing system. Do not proceed with work until the conditions have been corrected. Commencing work indicates acceptance of existing conditions and responsibility for performance of the applied repair materials and coatings.
- B. The Contractor shall remove all water from the tank by pumping. The Contractor is responsible for removing all standing water, mud and debris from the tanks prior to starting work.

3.4 SURFACE PREPARATION

- A. Power wash at 3,000 to 5,000 psi with hot water and detergent, using a rotating tip to remove all chalk, algae, mildew, dirt and loose paint prior to starting.
- B. Blast all surfaces in accordance with SSPC-SP13/NACE 6 to remove all existing coatings, laitance, loose and deteriorated concrete, and provide a 100-mesh sandpaper texture to all remaining sound concrete.
- C. Unsound or deteriorated areas shall be chipped away to sound concrete and prepared in accordance with manufacturer's recommendations.
- D. All cracks shall be repaired in accordance with the manufacturer's recommendations.
- E. All protrusions, fins, burrs and form lines shall be ground smooth prior to all other surface preparation work.
- F. All concrete that is not sound or has been damaged shall be removed to a sound concrete surface.
- G. All surfaces that show cracks or spalling greater than 1/8-inch wide shall be routed and cleaned, then patched using a quick setting, high strength cement mortar or a high build, non-sagging epoxy grout. Any holes to be filled should be done so in lifts according to manufacturer's recommendations.
- H. Surface preparation method(s) shall be based upon the conditions of the substrate and the requirements of the epoxy protective coating to be applied.
- I. All surfaces shall be repaired as required by the epoxy protective coating system in the intended service condition.
- J. Test prepared surfaces after cleaning but prior to application of the epoxy coating to determine if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.
- K. All surfaces shall be inspected during surface preparation and before the repair mortar is applied.

- L. All wastewater resulting from detergent water cleaning and power washing shall be properly disposed of, off-site, by the contractor.

3.5 APPLICATION OF REPAIR MATERIALS

- A. Apply repair materials only after completing surface preparation.
- B. Repair materials shall meet the specifications contained herein. The materials shall be trowel or spray applied utilizing proper equipment on to specified surfaces. The material thickness shall be specified by the Project Engineer according to manufacturer's recommendations.
- C. Cementitious repair materials shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating. No bugholes or honeycomb surfaces shall remain after the final trowel procedure of the repair mortar.
- D. The repair materials shall be permitted to cure according to manufacturer recommendations prior to application of coatings.
- E. Application of the repair materials, if not performed by the coating certified applicator, should be inspected by the protective coating manufacturer's representative of certified applicator to ensure proper finishing for suitability to receive the specified coating.
- F. After abrasive blast and leak repairs have been performed, all surfaces shall be inspected for remaining contamination of laitance, which shall be removed by additional abrasive blast, shotblast or other approved method. If repair materials are used, refer to these specifications for surface preparation. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the epoxy coating.
- G. All surfaces shall be inspected during and after preparation and before the protective coating is applied.

3.6 INSPECTION

- A. The Owner will inspect all phases of the work to verify that it is in accordance with the requirements of this section. Facilitate this inspection as required, including allowing ample time for the inspections and access to the work. Inspections may include, but are not limited to, surface preparation, cleanliness, application and adhesion.
- B. The presence or activity of the Owner inspections in no way relieves the Contractor of the responsibility to comply with all provisions of this section and to provide adequate inspections of its own.
- C. Furnish, until final acceptance of the repair system, all equipment and instrumentation needed to inspect all phases of the work.

END OF SECTION

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DIVISION 4 - MASONRY

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SECTION 04100

MORTAR

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide mortar as shown and specified.
2. This Section specifies the mortar for masonry materials specified in Section 04200, Structural Brick Masonry.

B. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 04200, Structural Brick Masonry.
3. Section 04201, Unit Masonry Construction.
4. Section 07600, Flashing, Gutters and Trim.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Wherever a fire resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour and similar designations), provide mortar in proportions complying with the requirements established by UL and the New York State Uniform Fire Prevention and Building Code.
- B. Source Quality Control: Do not change source or brands of mortar materials during the course of the Work.
- C. Presubmittal Meeting: Before submitting samples for approval, the Contractor and his supplier shall meet on-site with the Engineer to review existing masonry to be matched and preview proposed products.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 91, Masonry Cement.
2. ASTM C 136, Sieve or Screen Analysis of Fine and Coarse Aggregates.
3. ASTM C 144, and ASTM C 404, Aggregate for Masonry Mortar.
4. ASTM C 150, Portland Cement.
5. ASTM C 207, Hydrated Lime for Masonry Purposes.
6. ASTM C 270, Mortar for Unit Masonry.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of each type of colored mortar, showing the range of color which can be expected in the work. Label samples to indicate type and amount of colorant used. Engineer's review will be for color only. Compliance with all other requirements in the exclusive responsibility of the Contractor.
- B. Manufacturer's Data: Submit for approval, copies of manufacturer's specifications and instructions for each manufactured product.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Manufactured materials, such as cement and lime, shall be delivered and stored in their original unopened containers, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials:
1. Store mortar materials off the ground in a dry location and under a properly constructed shelter using tarpaulin, felt paper, or polyethylene sheets to prevent damage by the elements. Containers showing evidence of damage will be rejected.

2. Protect liquid admixtures from freezing.
3. Store aggregates in separate bins.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement:

1. ASTM C 150, Type I, nonstaining, without air entraining and of natural color or white, to produce the required color of mortar or grout.
2. Use ASTM C 150, Type III, high early strength, for laying masonry when outside temperature is less than 50°F.
3. Provide nonstaining portland cement, without air entraining and of natural color or of the color required to be compatible with the required colored mortar pigment selected by Engineer.
4. Product and Manufacturer: Provide one of the following:
 - a. Speed Portland Cement and Hi-Speed Portland Cement by Louisville Cement Company.
 - b. Atlas Type I Atlas Type III Portland Cement by Lehigh Portland Cement Company.
 - c. Or equal.
5. Product and Manufacturer: Provide one of the following:
 - a. White Portland Cement by Ideal Basic Industries.
 - b. Atlas White Portland Cement Type I and Type III by Lehigh Portland Cement Company.
 - c. Or equal.

B. Masonry Cement: Provide the following for masonry cement mortars:

1. ASTM C 91, Type S; proportioned as specified to comply with ASTM C 270.
2. Maximum Air Content, ASTM C 91: 18 percent.
3. Nonstaining and of the color required to be compatible with the required colored mortar pigment selected by Engineer.
4. Product and Manufacturer: Provide one of the following:
 - a. Brixment-in Color Type S by Louisville Cement Company.
 - b. Atlas Custom Color Masonry Cement Type S by Lehigh Portland Cement Company.
 - c. Or equal.

C. Hydrated Lime: ASTM C 207, Type S, or lime putty ASTM C 5.

D. Sand Aggregates:

1. ASTM C 144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
2. White Mortar Aggregates: Provide natural white sand or ground white stone for portland cement lime mortars.

E. Colored Mortar Pigments: Provide the following for Portland cement lime mortars:

1. Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black, compounded for use in mortar mixes.
2. Do not exceed pigment to cement ratios, by weight of 1 to 35 for carbon black and 1 to 7 for other pigments.

3. Product and Manufacturer: Provide one of the following:
 - a. Truetone Mortar Colors by Frank D. Davis Company Subsidiary Rockwood Industries Incorporated.
 - b. Sonobrite by Sonneborn Building Products Division Rexnord Chemical Products, Inc.
 - c. Or equal.
 4. Submit complete selection of manufacturer's standard and custom colors for final selection by Engineer.
- F. Water: Free from injurious amounts of oils, acids, alkalis, or organic matter, and clean, fresh and potable.
- G. Waterproofing Admixture:
1. Proportion: In strict accordance with manufacturer's instructions.
 2. Product and Manufacturer: Provide one of the following:
 - a. Omicron by Master Builders Co.
 - b. Hydroxide Powder by Sonneborn Building Products.
 - c. Or equal.

2.2 MORTAR MIXES

- A. General:
1. Antifreeze Admixture or Agents: Not permitted.
 2. Calcium chloride: Not permitted.
- B. Fire Resistant Mortar:
1. Standard: UL Design Numbers 0901, 0902, 0903, 0904, 0905, 0906, 0907 and 0908.

2. Proportion: Use 1 part portland cement, 3 parts clean sand, and 15 percent hydrated lime (by cement volume).

C. Mortar for All Unit Masonry: Comply with ASTM C 270. Table 2, except limit materials to those specified herein, do not substitute ASTM C 91 masonry cement for ASTM C 150 portland cement without an approved Shop Drawing review by Engineer, and limit cement to lime ration by volume as follows:

1. Type M:

- a. Portland Cement Lime Mortar; provide the following proportions by volume:

- 1) Portland Cement: 1 part.
- 2) Hydrated Lime or Lime Putty: 1/4 part.
- 3) Aggregate Ratio (measured in damp loose condition): not less than 2-1/4 and not more than 3 times the sum of the volumes of cement and lime.
- 4) Maximum Air Content, ASTM C 270: 12 percent.

- b. Portland Cement Masonry Mortar; provide the following proportions by volume:

- 1) Portland Cement: 1 part.
- 2) Masonry Cement: 1 part.
- 3) Aggregate Ratio (measured in damp loose condition): Not less than 2-1/4 and not more than 3 times to sum of the volumes of cement and lime.
- 4) Maximum air content, ASTM C 270: 18 percent.

- c. Property Specification:

- 1) Average Compressive Strength, ASTM C 270: 2,500 pounds per square inch.
- 2) Minimum Water Retention, ASTM C 270: 75 percent.

2. Type S:

a. Portland Cement Lime Mortar; provide the following proportions by volume:

- 1) Portland Cement: 1 part.
- 2) Hydrated Lime or Lime Putty: Over 1/4 to 1/2 maximum.
- 3) Aggregate Ration (measured in damp loose condition): Not less than 2-1/4 and not more than 3 times the sum of the volumes of cement and lime.
- 4) Maximum air content, ASTM C 270: 12 percent.

b. Portland Cement Masonry Mortar; provide the following proportions by volume:

- 1) Portland Cement: 1/2 part.
- 2) Masonry Cement: 1 part.
- 3) Aggregate Ratio (measured in a damp loose condition): Not less than 2-1/4 and not more than 3 times the sum of the volumes of cement and lime.
- 4) Maximum air content, ASTM C 270: 18 percent.

c. Property Specification:

- 1) Average Compressive Strength, ASTM C 270: 1,800 pounds per square inch.
- 2) Minimum Water Retention, ASTM C 270: 75 percent.

D. Color Pigmented Cement Mortar: For Portland cement lime mortars proportion pigments with other ingredients as follows:

1. Mix to match sample approved by Engineer.
2. For black mortar, mix with 1/8 part black iron oxide per part of Portland cement and reduce lime content to not more than 1/10 part.

E. Stearate Additive: Add to mix in amount equal to not more than 3 percent of the weight of cement.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measurement of Materials:

1. Mortar Cement and Hydrated Lime: Batched by the bag.
2. Sand: Batched by volume in suitably calibrated containers, provided proper allowance is made for bulking and consolidation and for weight per cubic foot, of contained moisture.
3. Proportion of volumetric Mixtures: One 94 pound sack of portland cement or one 50 pound sack of hydrated lime constitute nominal one cubic foot.
4. Shovel measurement: Not permitted.

B. Mortar Mixing:

1. Type of Mixer: Machine mix in approved mixer in which the quantity of water is accurately and uniformly controlled.
2. While mixer is in operation add approximately 3/4 the required water, 1/2 the sand, all the cement, then add remainder of sand.
3. Allow batch to mix briefly then add water in small quantities until satisfactory workability is obtained.

4. Mix for not less than five minutes after all materials have been added.
5. Hydrated Lime for Mortar Requiring Lime Content: Use dry-mix method. Turn over together the materials for each batch until the even color of the mixed, dry materials indicates that cementitious material has been thoroughly distributed throughout the mass, then add water to obtain required plasticity.
6. Lime putty if approved for use shall be prepared in accordance with ASTM C 5.
7. Waterproofing Admixture: Add to mortar mix for all exterior masonry in strict accordance with manufacturer's instructions.
8. The mixer drum shall be completely emptied before recharging the next batch.
9. Limit batch size to avoid retempering. Retempering of mortar shall not be permitted.
10. Mixers, wheelbarrows, mortar boards, etc., shall be kept clean.

3.2 MIXING PROCEDURE FOR MORTAR

- A. Measure material by volume or equivalent weight. In measuring by volume, use a container to measure ingredients. Do not measure by shovel.
- B. Rebuilding/Setting Mortar
 1. Mix ingredients in a clean mechanical mixer for a minimum of 3 minutes, maximum of 5, with the minimum amount of water to produce a workable consistency.
 2. Mortar that has stiffened because of evaporation of water from the mortar may be retempered only once, and only during the first hour of placement to restore the required consistency. Use mortar within 2¹/₂ hours of its initial mixing; tempering is permitted only once and during the first hour

only. Limit amount of mortar batched at one time to stay within these requirements.

C. Pointing Mortar

1. Add sufficient water to dry mix to produce a damp mix that will retain its shape when pressed into a ball by hand. Mix from 3 to 7 min. in a mechanical mixer.
2. Let mortar stand for not less than 1 hour nor more than 1½ hours for prehydration. Add sufficient water to bring mortar to proper consistency for tuck-pointing, somewhat drier than mortar used for laying units.
3. Use mortar within 2½ hours of its initial mixing; tempering is permitted only once after bringing mortar to proper consistency. Limit amount of mortar batched at one time to stay within these requirements.

- D. For prepackaged masonry repair mortar, mix with water or manufacturer's polymer in proportions defined by manufacturer to provide the required consistency.

3.3 Repointing Joints

A. The Contractor shall take all precautions required to ensure the original appearance of the building is maintained (not changed) and the existing brick is not damaged. The new mortar shall match the original in color & texture and the new joint shall match the existing joint tooling, size and profile. For joints that are set back from the brick face (raked joints), provide a sloping joint starting at the original depth at the top and sloping to the brick face at the bottom that will prevent water sitting on the brick while maintaining the intended shadow line.

- B. Rake or cut out joints to a minimum uniform depth of 3/4" and until sound surface is reached. Do not spall edges of masonry units or widen joints. Replace all brick damaged by such operations with new to match color, size, and texture.

1. Mortar Removal

Where cutting is required to remove existing mortar and joint filler, use a rotary power masonry saw wherever possible without damaging masonry. Masonry saw shall have a vacuum attachment to reduce dust. Use non-power tools for vertical brick joints or where rotary power masonry saw will damage joint.

2. Cut the mortar and joint filler cleanly from the sides of the joints, leaving square corners. Flush joints clean with water or compressed air.
- C. Dampen joints slightly before application of mortar, making sure there is no free water. Pack pointing mortar tightly in joints in thin layers (1/4" max.), with each layer "thumbprint hard" before applying the next layer. Tool joints to match existing adjoining joints.
1. Where joint sealant is required, backpack the joints tightly out to a uniform depth of 1/4", or as indicated on Drawings. Refer to Section 07900 for sealants. Apply bondbreaker tape prior to installing sealants.
- D. Cure mortar by maintaining in a damp condition for at least 72 hours.

3.4 FIELD QUALITY CONTROL

- A. The Contractor shall have an independent laboratory take samples and conduct tests to evaluate air entrainment, water retention and the compliance of materials with the specifications and to determine the compressive strength of mortar and grout. Tests shall be conducted in accordance with ASTM C 91. Tests results shall be made available prior to the commencement of work.
- B. After the initial test, the Engineer will require a maximum of 5 additional tests to be conducted at his discretion.
- C. Installed mortar that does not meet the requirements of the specification shall be immediately removed and rebuilt.

3.5 PROTECTION AND CLEANING

- A. Protect face of adjacent walls and surfaces from water, mortar, and grout used for terra cotta installation.
- B. Remove excess mortar and mortar smears as work progresses.
- C. After mortar has cured (a minimum of 30 days), clean soiled surfaces with detergent and clean water. Use fiber brushes and cloths. Do not use metallic tools or acids.

+ + END OF SECTION + +

SECTION 04201

UNIT MASONRY CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide unit masonry construction as shown and specified. The Work also includes:
 - a. Providing openings in masonry to accommodate the Work under this and other Sections and building into the masonry all items such as sleeves, anchor bolts, inserts and all other items to be embedded in masonry for which placement is not specifically provided under other Sections. Provide lintels in all openings or where directed by the Engineer.
 - b. Providing openings in masonry to accommodate the work under other contracts and assisting other contractors in building into the masonry all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in masonry under other contracts.
 - c. Cutting and removing existing masonry for new openings and new abutting walls.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the masonry.
2. Notify other contractors in advance of the construction of the masonry to provide the other contractors with sufficient time for the installation of items included in their contracts that must be installed with the masonry.

3. This Section specifies the installation of unit masonry specified in the following:

a. Section 04200, Structural Brick Masonry.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-in-Place Concrete.

2. Section 04100, Mortar.

3. Section 07560, Waterproofing.

4. Section 07600, Flashing, Gutters and Trim.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour, and similar designations), comply with applicable requirements for materials and installation established by UL and other governing authorities.

B. Codes and Reference Standards: Comply with the applicable requirements of the New York State Uniform Fire Prevention and Building Code for the types of masonry construction shown and the following standards: ANSI A41.1 R70 Code Requirements for Masonry. ACI 531.1 Specifications for Concrete Masonry Construction Brick Institute of America, "Technical Notes on Brick and Tile Construction". Brick Institute of America, Technical Bulletin 1A, "Construction and Protection Recommendations for Cold Weather Masonry Construction". Brick Institute of America, Technical Notes on "Cleaning Clay Products Masonry". National Concrete Masonry Association, "Guide Specifications" and "Technical Bulletins". UL, Design Numbers U901 through U908.

C. Construction Tolerances: In accordance with ACI 531.1 and the following:

1. Variation from Plumb: For lines and surfaces of columns, walls and arises, do not exceed 1/4 inch in 10 feet, or 3/8 inch in a story height or 20

feet maximum, nor 1/2 inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4 inch in any story or 20 feet maximum, nor 1/2 inch in 40 feet or more.

2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.

3. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/4 inch.

D. Presubmittal Meeting: Before erecting the job mock-up, the Contractor and his installer shall meet on-site with the Engineer to discuss approved products and workmanship to ensure a match to existing adjacent masonry.

E. Job Mock-up:

1. Prior to installation of unit masonry work, but after Engineer's approval of samples, erect job mock-up using materials, pattern bond and joint tooling shown or specified for final Work, to match existing adjacent masonry construction. Provide special features as directed including finished opening 1 foot-4 inches by 1 foot-4 inches, finished end, and expansion joint. Build mock-up at the site in location approved by the Engineer. The mockup shall be of full thickness and approximately 6 feet long by 4 feet high unless otherwise shown. Indicate the proposed range of color, texture and Workmanship to be expected in the completed work. Obtain Engineer's acceptance of visual qualities of the mock-up before start of masonry Work. Retain and protect mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until given written permission by Engineer. Masonry construction that does not meet the standards approved on the sample panel shall be removed and rebuilt as required by

Engineer. Provide mock-up panel for typical exterior and interior sections to match existing adjacent areas.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver all materials to the site in the manufacturer's original unbroken, undamaged and unopened packaging with labels bearing the name of the manufacturer and the product. Masonry units and brick shall be factory packaged and strapped, delivered to the site and stored on skids.

B. Storage of Materials:

1. Protect masonry materials during storage and construction with a properly erected shelter from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.
2. Store and handle all materials to prevent inclusion of water or foreign matter and to prevent damage of any nature. Packaged units kept in original unopened packages until time for use.
3. Distribute materials on floor slabs to prevent overloading. Designated live loads shown for floor shall not be exceeded.

C. Handling Materials:

1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished work.

1.4 JOB CONDITIONS

- A. Environmental Requirements: Do not place any masonry when air temperature is 40°F and falling. Masonry may be placed when air temperature is 32°F and rising. In either case, it may not be placed if temperature is expected to drop below 32°F during next 72 hours unless adequate protection is provided as specified in 1.4.B.4.b. below.
- B. Protection:
1. Protect partially completed masonry against weather, when Work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2 feet down both sides of walls and hold securely in place.
 2. Do not apply uniform floor or roof loading for at least three days after completing masonry columns or walls.
 3. Do not apply concentrated loads for at least seven days after completing masonry columns or walls.
 4. Cold Weather Protection.
 - a. When surrounding air temperature is 48°F to 40°F protect masonry construction from rain or snow for a minimum of 48 hours by covering with nonstaining weathertight membrane.
 - b. When surrounding air temperature is 40°F and below maintain masonry construction temperature above 40°F for a minimum of 48 hours by enclosure and supplementary heat, electric heating blankets, infrared lamps, or other methods acceptable as directed by the Engineer.
 5. Hot Weather Protection: Protect masonry construction, by methods acceptable to Engineer, from direct exposure to wind and sun when the surrounding air temperature is 99°F in the shade with relative humidity less than 50 percent.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to the following Sections for required masonry materials:
 - 1. Section 03300, Cast-In-Place Concrete.
 - 2. Section 04100, Mortar.
 - 3. Section 04150, Masonry Accessories.
 - 4. Section 04210, Brick Masonry.
 - 5. Section 04220, Concrete Unit Masonry.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which unit masonry Work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 PREPARATION

- A. Clean dirt, debris, oil, grease and other materials which would effect the bond of mortar from all surfaces to receive work under this Section.
- B. Wetting of Masonry Units:
 - 1. Brick: Wet brick having ASTM C 67 absorption rates greater than 0.25 ounce per square inch per minute.
 - a. Determine absorption by placing 20 drops of water inside a circle the size of a quarter on typical units. If water is absorbed within 1-1/2 minutes, wet brick before laying.
 - 2. Use wetting methods which ensure that each masonry unit is nearly saturated but surface dry when laid.

3. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.

3.3 INSTALLATION, GENERAL

- A. Thickness: Build walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete masonry Work to match Work immediately adjacent to openings.
- D. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.
- E. Matching Adjacent Existing Masonry Work: Match coursing, pattern bond color and texture of new masonry work with adjacent existing work.

3.4 LAYING MASONRY WALLS

A. General:

1. Mortar Types: Unless otherwise indicated, use mortar as specified in Section 04100, Mortar, and as follows:
 - a. For all Work, use Type S mortar.

- b. Do not use mortar which has begun to set or if more than 1/2 hour has elapsed since initial mixing. Retemper mortar during the 1/2-hour period only as required to restore workability.
 - c. Do not use mortar which has begun to set or if more than 1/2 hour has elapsed since initial mixing. Retemper mortar during the 1/2-hour period only as required to restore workability.
- 2. Layout walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, expansion joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.
 - 3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
 - 4. Pattern Bond: Lay exposed masonry in running bond and as shown to match adjacent existing masonry. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than 4-inch horizontal face dimensions at corners or jambs.

B. Mortar Bedding and Jointing:

- 1. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush in cross joints and do not furrow bed joints. Use trowel edge for flat bed joints. Fill all parapet blocks solid with grout.
- 2. Bed and lay brick and concrete masonry units at the proper angle with fully slushed joints.
- 3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers columns and pilasters and where adjacent to cells

or cavities to be reinforced or filled with concrete or grout.

- a. Maintain 3/8-inch joints, except for minor variations required to maintain half bond.
4. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, unless otherwise shown.
5. Tool exposed joints slightly concave, to match existing. Rake out mortar in preparation for application of caulking or sealants where required.
6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not hammer or otherwise force brick at corners, whether at jambs or changing the direction of a wall in order to force plumb the corner or jamb. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Collar Joints:

1. Fill the vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging, for the following masonry work:
 - a. All walls, except cavity walls, and interior walls and partitions.

- D. Stopping and Resuming Work: Rack back 1/2-brick length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

E. Built-in Work:

1. As the Work progresses, build in items shown, specified or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Fill cores in one block width solidly with masonry around built-in items.

- a. Fill space between hollow metal frames and masonry solidly with mortar.
- b. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of cavity fill mesh in the joint below and rod mortar or grout into core.

F. Interior Walls:

1. Nonload-Bearing Interior Partitions and Interior Wythe of Cavity Walls: Build full height of story to underside of structure above, unless otherwise shown.
2. Tie walls at top and sides with masonry anchors as specified in Section 04150. Insert compressible filler, specified in Section 04150, in all horizontal and vertical joints where masonry terminates. Insert filler $3/4$ inches from both faces of masonry. Use filler four times as thick as the widest part of the joint. Thickness of filler shall be a minimum of 4 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by 3 inches and compress ends to form tight joint. Finish with backer rod and sealant.
3. At masonry walls requiring a fire rating use fire safing insulation specified in Section 07210. Insert insulation in a continuous, vaportight, solid blanket to $3/4$ -inches from both faces. Finish with backer rod and sealant.

H. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 04150, Masonry Accessories, for type of reinforcing units required. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of $5/8$ inch on exterior side of walls and $1/2$ inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing.

2. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
4. Space continuous horizontal reinforcing as follows:
 - a. For multi-wythe walls, solid or cavity, where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16 inches on centers vertically.
 - b. For single wythe walls, space reinforcing at 16 inches on centers vertically, unless otherwise shown.
 - c. For parapets, space reinforcing at 8 inches on centers vertically, unless otherwise shown.
5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 24 inches beyond jambs of the opening.
 - a. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.

I. Anchoring Masonry Work:

1. Provide anchoring devices of the type shown and as specified under Section 04150, Masonry Accessories. If not shown or specified, provide standard type for facing and backup involved.

2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
 - a. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
 - b. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.
 - c. Space anchors as shown, but not more than 16 inches on center vertically and 36 inches on center horizontally.
3. Anchor single wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Anchor veneer to concrete back up with dovetail anchors.
 - c. Anchor veneer to existing concrete and masonry backup with corrugated anchors attached with stainless steel expansion bolts.

J. Control Joints:

1. Provide vertical expansion, control and isolation joints in masonry where shown. Build in related items as the masonry Work progresses. Rake out mortar in preparation for application of caulking and sealants. Refer to Section 07920, Caulking and Sealants.
 - a. Provide items specified under Section 04150, Masonry Accessories, where shown.

- 1) Build flanges of factory fabricated neoprene control joint into brick masonry and premolded control joint strips into concrete unit masonry. Refer to Section 04150.
 - 2) Build in compressible fillers specified under Section 04150, Masonry Accessories, where shown. Install in accordance with manufacturer's written instructions.
2. Control Joint Spacing: Where location of control joints are not shown, place vertical joints spaced not to exceed 50 feet-0 inches on centers for clay masonry or 35 feet-0 inches on centers for concrete masonry wythes if reinforced. Locate control joints in the masonry Work as shown and including the following:
- a. At structural column or joint between bays.
 - b. Above expansion or control joints in the supporting structure.
 - c. Above major openings at end of lintels upward and below at ends of sills downward. Place at one side of jamb for openings less than 6 feet-0 inches wide and at both sides for openings over 6 feet-0 inches wide.
 - d. At vertical chases, recesses and other points of reduction in wall thickness.
 - e. At locations where masonry wall height changes by more than 20 percent.
 - f. Where masonry abuts supporting structure.
 - g. At a distance equal to $1/2$ the wall height from corners or intersections with other masonry.
 - h. Submit joint locations to Engineer for approval.

K. Lintels:

1. Provide steel lintels and masonry U-block lintels, where shown on the Contract Drawings, and specified in Section 05504, Miscellaneous Metal Fabrications.
2. Provide masonry lintels where shown and wherever openings of 16 inches or more are shown without structural lintels. Provide precast or formed in place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
 - a. Unless otherwise shown, provide one horizontal reinforcing bar for each 4 inches of wall thickness, of size-number not less than the number of feet of opening width.
 - b. For hollow masonry unit walls, use specially formed "U" shaped lintel units with reinforcing bars placed as shown, filled with Type M mortar.
3. Provide minimum bearing at each jamb, of 4 inches for openings less than 6 feet-0 inches wide, and 8 inches for wider openings.

L. Flashing of Masonry Work:

1. Provide concealed flashings in masonry Work as shown. Refer to Section 07600, Flashing, and Section 07560, Waterproofing, for type of flashing required. Prepare masonry surfaces smooth and free from projections which might puncture flashing. Place through wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 inch from face of wall, unless otherwise shown.
 - a. Extend flashings beyond edge of lintels and sills at least 4 inches and turn up edge on sides to form pan to direct moisture to exterior.

- b. Install elastic flashings in accordance with manufacturer's instructions.
- 2. Provide 3/8" wide x 1 1/2" long plastic insert type weep joints in the head joints of the first course of masonry immediately above concealed flashings. Space 24 inches on center, unless otherwise shown.
- 3. Install reglets and nailers for flashing and other related work where shown to be built into masonry Work.
- 4. Install emergency scuppers as shown.

3.5 CUTTING AND REMOVING EXISTING MASONRY

- A. Wherever existing masonry is shown to be cut and removed use methods that will produce sharp, true edges to accept new abutting work.

3.6 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 - 1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's work.
 - 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain Engineer's acceptance of sample cleaning before proceeding to clean remainder of masonry work.

- a. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
- b. Presoak wall by saturating with water and flush off loose mortar and dirt.
- c. Scrub down wall with stiff fiber brush and a solution of 1/2 cup of trisodium phosphate and 1/2 cup of household detergent dissolved in one gallon of water.
- d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.
- e. Acid cleaning of masonry will not be permitted.

3. Clear Coatings: See Section 09900, Painting.

E. Protection:

1. Protect the masonry Work from deterioration, discoloration or damage during subsequent construction operations.
2. When work on any brick or block masonry is finished for the day or discontinued on account of rain or snow, or where top of new work is likely to be damaged by storms, sloping planks covered with tarred felt shall be placed over the top of walls.

+ + END OF SECTION + +

SECTION 04300

STRUCTURAL BRICK MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Brick masonry units.
- B. Related Sections:
 - 1. Section 04100 - Mortar.
 - 2. Section 04201 - Unit Masonry Construction.
 - 3. Section 07920 - Caulking and Sealants.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 33 - Specification for Concrete Aggregates.
 - 2. C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
 - 3. C 126 - Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
 - 4. C 270 - Specification for Mortar for Unit Masonry.
 - 5. C 652 - Specification for Hollow Brick.
 - 6. C 1019 - Method of Sampling and Testing Grout.
- B. International Building Code (ICC) adopted addition.
- C. Building Code Requirements for Masonry Structures (ACI 530, 530.1) adopted addition.

1.3 SUBMITTALS

- A. Product Data and Evaluation Reports as required for installation.

- B. Shop Drawings: Include elevations of each wall indicating type and layout of units.
- C. Samples: Include samples of stretcher units in sufficient quantity to illustrate color range.
- D. Test Reports from an independent testing laboratory showing compliance with applicable specifications.

1.4 QUALITY ASSURANCE

A. Continuous Inspection:

1. Employ a qualified masonry inspector for continuous inspection of the masonry work. Acceptance by a State or municipality having a program of examining and certifying masonry inspectors will be considered adequate qualifications. The masonry inspector shall be at the site during all masonry construction and perform the following duties:
 - a. Review Drawings and Specifications and meet with the CONTRACTOR to discuss requirements before work commences.
 - b. Before masonry work commences, CONTRACTOR and the Contractor's Quality Control Representative shall attend meeting with ENGINEER to review the requirements for surveillance and quality control of the masonry work.
 - c. Check brand and type of cement, lime (if used), and source of sand.
 - d. Ensure that foundation is clean, rough, and ready to receive units.
 - e. Check reinforcing steel dowels for straightness, proper alignment, spacing, size, and length.
 - f. Observe field proportioning of mortar. Visually check aggregate to determine uniformity of grading, cleanliness, and moisture.

- g. Ensure that joints are full of mortar and kept tight during work. Inspect grout cells to assure that fins will not interfere with grouting. Ensure that masons keep grout cells clean of mortar droppings and inspect to determine compliance.
 - h. Continuously observe placing of grout.
 - i. Perform or supervise performance of required sampling and testing.
2. Keep complete record of inspections. Report daily to the Contractor's Quality Control Representative the progress of the masonry inspection.

B. Mock-up:

- 1. Prior to starting construction of masonry, construct minimum 4 foot square mock-up.
- 2. Use accepted materials, containing each different kind and color of brick masonry units to illustrate wall design.
- 3. Show color range, texture range, bond, mortar color, joint tooling, critical design details and quality of workmanship.
- 4. Masonry construction may not proceed until the Architect./ Engineer approves mock-up.
- 5. When not accepted, construct another mock-up.
- 6. When accepted, mock-up will be standard of comparison for remainder of masonry work.
- 7. Upon completion and acceptance of Project, dispose of mock-ups in legal manner at offsite location.

C. Masonry Prism Testing: Perform masonry prism testing in accordance with ASTM C1314 Standard Test Method for Compressive Strength of Masonry Prisms.

- D. Certification: Furnish manufacturer's certification that clay brick units provided meet or exceed the requirements of this specification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
- B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.
- C. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.
- D. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
- E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.6 PROJECT CONDITIONS

- A. Cold Weather Requirements:
 - 1. In accordance ACI 530.1 1.8.c
 - 2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.
- B. Hot Weather Requirements:
 - 1. In accordance with ACI 530.1 1.8.d
 - 2. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
 - 3. Wet mortar board before loading and cover mortar to retard drying when not being used.
 - 4. Do not spread mortar beds more than 48 inches ahead of placing masonry units.

5. Place masonry units within one minute of spreading mortar.

C. Wetting of Brick: shall be required at the time of laying if the unit's initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/ 645mm².

1.7 SEQUENCING AND SCHEDULING

A. Because structural brick fall in the critical path of construction, the General contractor should contact the supplier for availability and scheduling prior to selecting a mason contractor to assure adequate time for manufacturing.

PART 2 - PRODUCTS

2.1 HOLLOW LOAD BEARING BRICK MASONRY UNITS

A. Manufacturers:

1. Interstate Brick Co.

2. H. C. Muddox Co.

a. Distributed by BTSBM; 212-686-3939

3. Or approved equal.

B. Type: ASTM C 652, Grade SW, Type HBX with minimum compressive strength of 8000 psi.

C. Surface Texture: To be selected by Owner from manufacturer's full range of available textures.

D. Colors:

1. Color as selected by Owner from standard colors.

E. Size: 2-1/4" Quartette

1. 7-9/16" deep x 2-1/4" high x 15-9/16" long

F. Special Sizes and Shapes: As required for window and door soldier coursing and custom sills where indicated, corners, bond beams, piers, lintels,

control joints, and other special applications to minimize cutting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of brick masonry units.
- B. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

3.2 BRICK MASONRY UNITS

- A. Provide Custom Level of Quality in accordance with ASTM C652 and C216.
- B. Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units.
- C. Lay units to preserve unobstructed vertical continuity of cells to be filled with grout or insulation.
- D. Protect cells intended to remain free of grout using grout stops, mortar dams, or by other means.
- E. Align vertical cells to be filled with grout to maintain clear, unobstructed continuous vertical cell measuring not less than 2 by 3 inches.
- F. Butter vertical head joints for thickness equal to face shell thickness of units, and shove joints tightly together so that mortar bonds to both masonry units.
- G. Solidly fill joints from face of units to inside face of cells.
- H. Lay units to desired height with joints of uniform thickness.
- I. Bond shall be plumb throughout.

- J. Lay units to avoid formation of cracks when units are placed. Keep cells of units as free of mortar as possible as masonry wall height increases.
- K. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the tolerances of ACI 530.1 Section 3.3 F.
- L. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
- M. Remove mortar, mortar droppings, debris, and other obstructions and materials from inside of cell walls.
- N. Seal cleanouts after inspection and before grouting or placing insulation.

3.3 MOLDED POLYSTYRENE INSULATION

- A. Lay brick masonry units protecting cells to receive grout from filling into those not intended to be grouted.
- B. Place molded polystyrene insulation inserts into cells not intended to be grouted.
- C. Ensure that no insulation gets into cells which are to be filled with grout.
- D. Do not lay units more than 4 feet vertically ahead of units filled with molded polystyrene insulation.

3.4 MORTAR JOINTS

- A. Make joints straight, clean, smooth, and uniform in thickness.
- B. Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush.
- C. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in ACI530.1 Section 3.3 F.

- D. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

3.5 BOND PATTERN

- A. Lay brick masonry units in running bond pattern, unless otherwise indicated on the Drawings.

3.6 GROUTING AND REINFORCEMENT

- A. Provide splices in vertical and horizontal reinforcing as outlined in ACI 530 Section 1.14, 1.15, 1.16 and Section 2.3 and 3.3. Hold vertical reinforcing bars in position at top and bottom and at intervals not exceeding 200 bar diameters. Use steel wire bar positioners to position bars and tie reinforcing bars to dowels with wire ties.
- B. Obtain acceptance of reinforcement placement before grouting.
- C. Fill all spaces and cells containing reinforcing or intended to be grouted solidly with grout.
- D. Low-lift Grouting:
 - 1. Hollow unit masonry to be grouted by the low lift method shall be constructed and grouted in lifts not exceeding 4 feet. Double wythe masonry which will be grouted by the low-lift method shall be constructed and grouted in lifts not exceeding 8 inches. Slushing with mortar will not be permitted.
- E. High-lift Grouting:
 - 1. If grouting is accomplished by the high-lift method, double wythe masonry shall be allowed to cure at least 72 hours and hollow unit masonry shall be allowed to cure at least 24 hours before grouting.
 - 2. In double wythe construction, vertical grout barriers shall be built across the grout space to the height of the grout lift.

3. Grout barriers shall not be spaced more than 30 feet apart. Grout shall be placed in lifts not to exceed 6 feet in depth.
 4. Each lift shall be allowed to set for 10 minutes after initial consolidation of grout before successive lift is placed.
 5. The full height of each section of wall shall be grouted in one day.
- F. Grout in cells shall have full contact with surface of concrete footings.
- G. When grouting stops for one hour or longer, form horizontal construction joints by stopping grout placement 1-1/2 inches below top of uppermost unit containing grout.
- H. After placement, consolidate grout using mechanical immersion vibrators designed for consolidating grout.
- I. Placement:
1. Use a hand bucket, concrete hopper, or grout pump.
 2. Place grout in final position within 1-1/2 hours after mixing.
 3. Place grout so as to completely fill the grout spaces without segregation of the aggregates.
 4. Do not insert vibrators into lower grout placements that are in a semi-solidified state.

3.7 BOND BEAMS

- A. Place horizontal reinforcement and solidly grout bond beam units in place.
- B. Provide wire mesh at openings in bottom of bond beams to support grout where walls are not grouted solid.

3.8 CUTTING BRICK MASONRY UNITS

- A. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form

chases, openings, for anchorage, and for other appurtenances.

- B. Cut and fit units with power-driven carborundum or diamond disc blade saw.

3.9 CONTROL JOINTS / EXPANSION JOINTS

- A. Provide in masonry walls where indicated on the Drawings.
- B. Make full height and continuous in appearance.
- C. Run bond beams and bond beam reinforcing bars continuously through control joints. Stop horizontal reinforcing at expansion joints
- D. Insert control joint filler in joints as wall is constructed.
- E. Insert 50% compressible neoprene expansion joint material in expansion joints.
- F. Apply sealant as specified in Section 07900.

3.10 OPENINGS AND LINTELS

- A. Place horizontal reinforcement in fully grouted bond beam units.
- B. Use lintel units where underside of lintel will be exposed.
- C. Provide minimum of 8 inch bearing at each end of lintel.
- D. Embed reinforcing bars minimum 24 inches or 40 bar diameters, whichever is longer, into wall past edges of openings or as indicated on the Drawings.
 - 1. At corners, provide 90 degree bend with equivalent total embedment.

3.11 STEEL DOOR FRAMES

- A. Anchor and fully grout jambs and head of steel door frames connected to brick unit masonry.

- B. Fill frames with grout as each 2 feet of brick unit masonry is laid.

3.12 BEARING PLATES

- A. Provide minimum of 12 inches of grouted brick unit masonry below steel bearing plates and beams bearing on masonry walls.

3.13 ANCHOR BOLTS

- A. Hold anchor bolts in place with template during grouting to assure precise alignment.
- B. Do not cut or ream members being anchored or use other means to accommodate misaligned anchor bolts in roof deck support angles.
- C. Provide minimum 6 inch wide grouted brick unit masonry entirely around anchor bolts and other attachment devices.

3.14 ENCLOSURES

- A. Where brick masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
- B. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
- C. Do not cover enclosures until inspected and when appropriate, tested.

3.15 OTHER EMBEDDED ITEMS

- A. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

3.16 PATCHING

- A. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be

indistinguishable from similar surroundings and adjoining construction.

3.17 MISCELLANEOUS

- A. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

3.18 WATER REPELLENT

- A. Apply water repellent as specified in Section 07190.

3.19 FIELD QUALITY CONTROL

- A. Have minimum 3 masonry units of each type proposed for Project tested in accordance with ASTM C 67 to verify conformance to Specifications.
- B. Tests shall include compressive strength, absorption, Initial Rate of absorption and unit weight.
- C. Perform compressive strengths on structural units by cutting the units in half lengthwise and into rectangular unit without any flanges and cap according to ASTM C67 prior to testing.
- D. Employ and pay acceptable independent testing laboratory to perform testing.

3.20 CLEANING

- A. Exercise extreme care to prevent mortar splashes.
- B. Do not attach construction supports to masonry walls.
- C. Wash off brick scum and grout spills before scum and grout set.
- D. Remove grout stains from walls.
- E. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.

- F. Correct efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer.
 - 1. Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
 - 2. Do not use muriatic acid as cleaning solution.
 - 3. Do not use sandblast cleaning equipment.

3.21 FORMS AND SHORES

- A. Where required, construct forms to the shapes indicated on the Drawings.
 - 1. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
 - 2. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
 - a. Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
 - b. Wait at least 64 hours before applying concentrated loads.

3.22 PROTECTION

- A. Provide temporary protection for exposed masonry corners subject to damage.
- B. Bracing:
 - 1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.

2. Keep bracing in place until permanent supporting elements of structure are in place.

C. Limited Access Zone:

1. Establish limited access zone prior to start of masonry wall construction.
2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.
3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

3.23 GROUTING EQUIPMENT

A. Grout Pumps:

1. Do not pump grout through aluminum tubes.
2. Operate pumps to produce a continuous stream of grout without air pockets.
3. Upon completion of each days pumping, eject grout from pipeline without contamination or segregation of the grout.
 - a. Remove waste materials and debris from the equipment.
 - b. Dispose of waste materials, debris, and all flushing water outside the masonry.

B. Vibrators:

1. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout.
2. Maintain at least one spare vibrator, at the site at all times.

3. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine.
4. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

++ END OF SECTION ++

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DIVISION 5 - METALS

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SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide the structural steel, including surface preparation and shop priming, as shown and specified.
2. Structural steel is that work defined in AISC "Code of Standard Practice", Section 2, and as shown. The Work also includes:
 - a. Providing openings in and attachments to structural steel to accommodate the Work under this and other Sections and providing for the structural steel all items such as anchor bolts, studs and all items required for which provision is not specifically included under other Sections.

B. Coordination: Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the structural steel.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete (grout is specified therein).
2. Section 05503, Anchor Bolts, Expansion Anchors and Concrete Inserts.
3. Section 05504, Miscellaneous Metal Fabrications.
4. Section 09900, Painting (surface preparation and shop priming is specified therein).

1.2 QUALITY ASSURANCE

A. Reference Standards and Codes: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. ASTM A 36, Structural Steel.
2. ASTM A 108, Cold Finished Carbon Steel Bars and Shafting.
3. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
4. ASTM A 325, High Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened washers.
5. ASTM A 490, Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
6. AWS D1.1, Structural Welding Code.
7. AISC, Manual of Steel Construction.
8. AISC, Code of Standard Practice for Steel Buildings and Bridges.
9. AISC, Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings and including the Commentary and Supplements thereto as issued.
10. Specifications for Structural Joints using ASTM A 325 or A 490 Bolts, approved by the Research Council on Riveted and Bolted Structural Joints (RCRBSJ) of the Engineering Foundation, and endorsed by AISC.

B. Design of Members and Connections:

1. All details shown are typical; similar details apply to similar conditions, unless otherwise shown or specified. Verify dimensions at the site without causing delay in the Work.

2. Contractor shall examine conditions under which structural steel is to be provided, and notify Engineer in writing of unsatisfactory conditions existing or whenever design of members and connections may not be clearly indicated. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected.

C. Source Quality Control:

1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field. Such inspections and tests will not relieve the contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Fabrication shall be performed by a structural steel fabricating plant possessing a current certificate from AISC stating that the plant satisfies the requirements for certification for Category II of the AISC Quality Certification Program. The plant shall maintain this certification for the entire time fabrication for this project is being performed.

D. Qualifications for Welding Work:

1. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code" D1.1, Section 5, Qualification.
2. Provide certification that all welders employed on or to be employed for the work have satisfactorily passed AWS qualification tests within the previous 12 months. Contractor shall ensure that all certifications are kept current.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit for approval Shop Drawings including complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures and diagrams showing the sequence of erection.

- a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
 - b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
2. Submit for approval, copies of manufacturer's specifications and installation instructions for products listed below. Include laboratory test reports and other data as required to show compliance with these specifications.
- a. Structural steel of each type, including certified copies of mill reports covering the chemical and physical properties.
 - b. High-strength bolts of each type, including nuts and washers.
 - c. Unfinished bolts and nuts.
 - d. Prime shop coat of paint compatible to finish coat, see Paint Section 09900.
 - e. Touch-up field primer paint.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.
 1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay that Work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or

replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Rolled Steel Plates, Shapes and Bars: ASTM A 36, except where other type steel is shown.
- B. Anchor Bolts: ASTM A 307, nonheaded type unless otherwise shown or specified.
- C. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325
- D. Electrodes for Welding: E70 complying with AWS D1.1, Design of New Buildings, Section 8. AWS D1.1.
- E. Surface Preparation and Shop Priming: All structural steel shall be primed in the shop. Surface preparation and shop priming are included herein but are specified in Section 09900, Painting.
- F. All aluminum surfaces that shall be embedded or will come in contact with concrete shall be bituminous coated.
- G. All galvanized elements that will be embedded or will come in contact with concrete and mortar will require a chromate coating. This coating shall be applied in the factory by either dipping the galvanized elements in a solution of sodium or potassium dichromate acidified with sulfuric acid or spraying this solution on the galvanized surfaces.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. General:

- a. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC, Manual of Steel Construction, and as shown on the Shop Drawings. Provide camber in structural members as shown.
- b. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- c. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.

B. Connections:

1. Shop Connections:

- a. Unless otherwise shown, shop connections shall be welded or high strength bolted and shall be friction type connections. Unless otherwise shown, all welds shall be 1/4 inch minimum.
- b. Wherever reaction values of a beam are not shown, the connections shall be designed to support the total uniform load capacity tabulated in the AISC tables for allowable loads on beams for the given shape, span, and steel specified for the beam in question.
- c. Shop welded connections shall be designed to eliminate or minimize eccentricity. The size, extent, location and type of all shop welds shall be clearly shown on the Shop Drawings by use of AWS standard notations and symbols.

- d. End connection angles fastened to the webs of beams and the thickness of the angles, size and extent of fasteners or shop welds shall conform to tables of "Framed Beam Connections" in the AISC Manual. All connections shall be two sided, unless otherwise shown.
 - e. Girts, continuous plate girder and I-beam spans, skew portals, skew connections, rigid frames, etc., shall be completely assembled in the shop and accurately adjusted to line and camber. Holes for field connections shall be drilled or reamed while assembled. Holes for other connections, except those in lateral, longitudinal, and sway bracing, shall be drilled or reamed in the shop with the connecting parts assembled; or drilled or reamed to a metal template with hardened bushings, without assembling.
2. Field connections:
- a. All field connections unless otherwise specified below or noted shall be made with high strength bolts, and shall be friction type connections.
 - b. Field welding is permitted only where noted or approved by the Engineer.
 - c. Field bolted joints for girders shall be completely assembled, the members adjusted for line and camber, and holes for field connections drilled or reamed while assembled.
3. High-Strength Bolted Construction:
- a. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

- b. High strength bolt design shear values shall be as specified in the AISC Manual for bolts with threads in the shear plane.
 - c. The minimum size of bolts shall be 3/4-inch diameter, unless otherwise noted.
 - 4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
 - 5. Where rigid connections are required for conditions shown, web shear reinforcement and stiffeners per AISC Specifications shall be provided.
- C. Bracing:
 - 1. Bracing, for which a calculated stress is not shown, shall have a minimum two bolt connection or a shop welded connection of equivalent strength.
 - 2. Vertical bracing and knee braces connecting to columns shall be on the centerline of the columns, unless otherwise noted.
 - 3. Knee braces shall be at 45 degree angle, unless otherwise shown or noted.
 - 4. All gussets shall be minimum 3/8-inch thick, unless otherwise shown.
- D. Columns: Column shafts shall have "finished" bearing surfaces at the base and at all splice lines.
- E. Holes and Appurtenances for Other Work:
 - 1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the Shop Drawings. If large blockouts are required and approved, the webs shall be reinforced to develop specified shears. Provide threaded nuts

welded to framing and other specialty items as shown to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
3. Coordinate as specified in Paragraph 1.1.

PART 3 - EXECUTION

3.1 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Surveys: Provide services of a registered surveyor to check lines and elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices before steel erection proceeds. Discrepancies shall be reported immediately to the Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to the structural steel work have been agreed upon with the Engineer.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work. Contractor shall provide sufficient planking to meet OSHA requirement.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
 1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

2. All bolted connections with high strength bolts shall use Direct Tension Indicator Devices in accordance with Paragraph 8(d)(4) of the "Specification for Structural Joints using ASTM A325 or A490 Bolts," approved by the Research Council on Structural Connections, November 13, 1985. High strength bolts shall be installed in properly aligned holes and tightened to at least the minimum tension specified in the table below. Alternately, calibrated wrench tightened may be used in lieu of Direct Tension Devices, provided the requirements of paragraph 8(d)(2) of the same specifications are met. Fastener Tension Required for Slip-Critical Connections and Connections Subject to Direct Tension

Nominal Bolt Size (inches)	Minimum Tension in 1000's of Pounds (kips)	
	A325 Bolts	A490 Bolts
3/4	28	35
7/8	39	49
1	51	64
1-1/8	56	80
1-1/4	71	102
1-3/8	85	121
1-1/2	103	148

Wrenches may be manual torque or power wrenches designed by the manufacturer for use with high strength bolts. If manual torque wrenches are used, their dials shall be calibrated on the job. If power wrenches are used, the manufacturer's recommendations shall be carefully followed and proper working conditions of the machine demonstrated before the work is started.

The inspector shall approve the procedure for calibration of wrenches and installation of bolts and in general shall satisfy himself that all requirements of the specifications for "Structural Joints Using ASTM A325 or A490 Bolts" are met.

- F. Setting Bases and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.
 2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
 3. Place grout between bearing surfaces and bases or plates as specified in Section 03300. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.
 4. Leveling plates and wood wedges will not be permitted.
- G. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of the structure within tolerances as specified in AISC Manual. For members requiring accurate alignment, clip angles, lintels and other members shall be provided with slotted holes for horizontal adjustment at least $\frac{3}{8}$ inch in each direction, or more when required.
 2. Splice members only where shown or specified.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Manual for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.

1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Touch-Up Painting:
1. Unless otherwise specified below comply with all requirements of in Section 09900, Painting.
 2. Immediately after erection, clean field welds, bolted connections, and all damaged and abraded areas of the shop paint. Apply paint to exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

+ + END OF SECTION + +

SECTION 05503

ANCHOR BOLTS, EXPANSION ANCHORS AND CONCRETE INSERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide anchor bolts, expansion anchors and concrete inserts as shown and specified.

B. This section includes all bolts, anchors and inserts required for the Work but not specified under other Sections.

C The types of work using the bolts, anchors and inserts include, but are not limited to the following:

1. Rails.
2. Hangers and brackets.
3. Equipment, frames and bases.
4. Structural steel.
5. Piping.
6. Electrical.
7. Grating.
8. Ladders.

D. Related Work Specified Elsewhere:

1. Section 05102, Structural Steel.
2. Section 05504, Miscellaneous Metal Fabrications.
3. Section 05532, Aluminum Grating.
4. Section 18180, Miscellaneous Appurtenances.

5. Section 18094, Pipe Hangers and Supports.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.

1. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.

2. ASTM A 320, Alloy-Steel Bolting Materials for Low-Temperature Service.

B. Expansion anchors and inserts shall be UL or FM approved.

1.3 SUBMITTALS

A. Samples: Submit for approval representative samples of bolts, anchors and inserts as may be requested by the Engineer. His review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of Contractor.

B. Shop Drawings: Submit for approval the following:

1. Setting drawings and templates for location and installation of anchorage devices.

2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.

B. Determine design loads as follows:

1. For equipment anchors, use the design load recommended by the manufacturer and approved by the Engineer.
2. For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
3. Allowances for vibration are included in the safety factor specified above.
4. Anchors shall develop ultimate shear and pull-out loads of not less than the following values in concrete:

<u>Bolt Diameter</u> <u>(Inches)</u>	<u>Minimum Shear</u> <u>(Pounds)</u>	<u>Minimum Pull-Out</u> <u>Load (Pounds)</u>
1/2	4,500	6,300
5/8	6,900	7,700
3/4	10,500	9,900

2.2 MATERIALS

A. Anchor Bolts:

1. Provide stainless steel anchor bolts complying with ASTM A320.

B. Expansion Anchors:

1. Provide stainless steel anchors. Anchors shall be of the size required for the concrete strength specified. Provide stud type (male thread) or flush type (female thread), as required.
2. Product and Manufacturer: Provide anchors by one of the following:
 - a. Molly Division of USM Corporation.
 - b. Hilti, Incorporated.

c. Or equal.

C. Adhesive Anchors:

1. Provide stainless steel HVA adhesive anchors as shown on Contract Drawings.
2. Product and Manufacturer:
 - a. Hilti, Incorporated
 - b. Or equal.

D. Concrete Inserts:

1. Provide stainless steel inserts. Provide those recommended by the manufacturer for the required loading.
2. Manufacturer: Provide one of the following inserts:
 - a. ITT Grinnell.
 - b. Hohmann and Barnard, Inc.
 - c. Or equal.

E. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by Engineer.

F. Connection Bolts, Nuts and Washers: Materials shall be as specified in other Sections of the Specifications, or shown on the Drawings. Where materials are not specified or shown on the Drawings, they shall be of Type 304 stainless steel.

G. Toggle Bolts:

1. Provide stainless steel spring wing toggle bolts of the size required for secure anchorage of individual items, but not less than 1/4" diameter, of length required.
2. Product and Manufacturer: Provide one of the following:

- a. Spring Wing Toggle Bolts by Ramset Fastening Systems.
- b. No. 3000 Series, Snapin Toggle Bolts by Star.
- c. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- B. Assure that embedded items are protected from damage and are not filled in with concrete.
- C. Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller. Expansion anchors shall not be used for larger pipe unless otherwise shown or approved by the Engineer.
- D. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
- E. Unless recommended in bolt manufacture's literature or approved by the Engineer, conform to following for expansion anchors:
 - 1. Minimum embedment depth in concrete: 5 diameters.
 - 2. Minimum anchor spacing on centers: 10 diameters.
 - 3. Minimum distance to edge of concrete: 5 diameters.
 - 4. Increase dimensions above if required to develop the required anchor load capacity.
- F. Chromate Coating: All galvanized elements that will be embedded in or will come in contact with concrete mortar will require a chromate coating. This coating should be accomplished by either dipping the galvanized elements in a solution of sodium or potassium dichromate

SECTION 05504

MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide miscellaneous metal fabrications including surface preparation and shop priming, as shown and specified.
- B. The extent of miscellaneous metal fabrications Work is shown on the Drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, castings and extrusions, which are not a part of the structural steel or other metal systems covered by other Sections of these Specifications.
- C. The types of miscellaneous metal items include, but are not limited to the following:
 - 1. Ladders.
 - 2. Embedded steel plates.
 - 3. Miscellaneous framing and supports
- D. Related Work Specified Elsewhere:
 - 1. Section 03300, Cast in Place Concrete.
 - 2. Section 05523, Aluminum Handrails and Railings.
 - 3. Section 05532, Aluminum Grating.
 - 4. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified:
 - 1. ASTM A 36, Structural Steel.

2. ASTM A 42, Mild Low Carbon Steel, and Wrought Iron.
 3. ASTM A 93, Zinc Coated (Galvanized) Iron or Steel Sheets, Coils, and Cut Lengths, 2.5 oz. Coating Class Unless Otherwise Specified.
 4. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
 5. ASTM A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 6. ASTM A 276, Stainless and Heat-Resisting Steel Bars and Shapes.
 7. ASTM A 386, Zinc Coating (Hot-Dip) on Assembled Steel Products.
 8. ASTM B 26, Aluminum-Alloy Sand Castings.
 9. ASTM B 211, Aluminum-Alloy Bars, Rods and Wire.
 10. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 11. ANSI A14.3, Safety Requirements for Fixed Ladders.
 12. AWS D1.1, Structural Welding Code.
- B. Field Measurements: Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- C. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and erection of all assemblies of miscellaneous metal Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for location and installation of miscellaneous metal items and anchorage devices.
2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36 - Hot Dipped Galvanized.
- B. Mild Low Carbon Steel: ASTM A 42.
- C. Aluminum:
 1. Alloy and Temper: Provide alloy and temper as shown or specified, or as otherwise recommended by the aluminum producer or finisher.
 2. Extruded Shapes and Tubes: ASTM B 221.
 3. Plate and Sheet: ASTM B 209.
 4. Bars, Rods and Wire: ASTM B 211.
 5. Castings: ASTM B 26, Alloy 713 Temper T5.
- D. Zinc Coated Hardware: ASTM A 153.
- E. Stainless Steel Type 304L, Type 316L.
- F. Surface Preparation and Shop Priming: All steel shall be primed in the shop. Surface preparation and shop priming are included herein but are specified in Section 09900, Painting.

2.2 MISCELLANEOUS METAL ITEMS

A. Vent Screens:

1. A vent screen shall be furnished and installed on each vent and overflow pipe. Unless otherwise shown on the Contract Drawings, the vent screen shall consist of a circular frame sized and drilled to match the pipe flange and 1/2 inch square mesh fastened to the frame. The frame and mesh shall be of Type 304 stainless steel. The mesh shall not be less than 14 gage. Fasteners shall be of Type 316 stainless steel.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous metal framing and supports which are not a part of the structural steel framework and are required to complete the work.
2. Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates, doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all welded construction using metered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.

C. Fasteners and Fittings: Provide stainless steel, Type 316L, for all aluminum fabrications, and zinc coated hardware for all galvanized fabrications and items embedded in concrete, unless otherwise shown or specified.

D. Expansion Shield Fasteners: Fasteners shall be as specified in Section 05503.

E. Primer Paint: Unless otherwise shown or specified, prepare surfaces and prime steel items as required under Section 09900, Painting, of these Specifications.

F. Field Paint: Field paint is included in Section 09900, Painting.

- G. Galvanizing: All galvanizing of fabricated steel items to comply with the requirements of ASTM A 123.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set miscellaneous metal fabrications accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in form work where fabrications are to be built into concrete, or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible.
- C. Fit exposed connections accurately together to form tight hairline joints. Weld steel connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind steel joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. Touch-up galvanized surfaces damaged during construction with galvanizing repair paint applied in accordance with the manufacturer's instructions.
- E. Protection of Aluminum from Dissimilar Materials: Using approved washers, strips or sheets of felt, and asphaltic or zinc chromate paint, protect all surfaces of aluminum from contact with dissimilar materials such as concrete, steel, nonferrous metals, etc.
- F. Chromate coating: All galvanized elements that will be embedded in or will come in contact with concrete shall be chromate coated. This coating shall be applied in the factory by either dipping the galvanized elements in a solution of sodium or potassium dichromate acidified with sulfuric acid or spraying this solution on the galvanized surfaces.

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SECTION 05523

ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals to provide aluminum handrails and railing systems as shown and specified. The Work also includes:
 - a. Providing openings in and attachments to railings to accommodate the Work under this and other Sections and providing for the railings all items such as anchor bolts, fasteners, studs and all items required for which provision is not specifically included under other Sections.
 - b. The type of railing required is a welded system as shown on the Contract drawings.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the railings.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 05503, Anchor Bolts, Expansion Bolts and Concrete Inserts.
3. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

- A. Codes:** Comply with applicable requirements of the New York State Uniform Fire Prevention and Building Code.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM B 241, Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
2. AWS D10.7, Gas Shielded-Arc Welding of Aluminum and Aluminum Alloy Pipe.
3. The Aluminum Association, Aluminum Standards and Data; and Standards for Anodized Architectural Aluminum.
4. ANSI A12.1, Safety Requirements for Floor and Wall Openings, Railings, and Toeboards.
5. OSHA Part 1910.23 - Guarding Floor and Wall Openings and Holes.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings for the fabrication and erection of aluminum handrails and railings. Include plans, elevations, and details of sections and connections. Show anchorage items.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pack and ship all railing to protect finish.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Contractor shall provide a handrail and railing system that conforms to OSHA, Part 1910.23, 200 pound loading requirement. In addition, the system shall conform to the following requirements of ANSI A12.1:

1. Completed railing to withstand a load of 25 pounds per linear foot applied in any direction at the top of the railing.
2. Intermediate rail to withstand a horizontal load of 20 pounds per linear foot.

3. All above loads are not additive.
4. There shall be no permanent deflection after testing.

2.2 MATERIALS

- A. Extruded Aluminum Pipe and Tube: B 241, Alloy 6061-T6. Schedule 40 for rails and Schedule 80 for posts.
- B. Two Rail System:
 1. Use a welded pipe railing system with top and intermediate rail of 1-1/2 inch I.D. Schedule 40 aluminum and posts of 1-1/2" I.D. Schedule 80, Alloy 6061-T6 with ground joints.

2.3 FABRICATION

- A. Top rail shall be continuous over posts, and posts continuous from base to top rail. Intersections of rails and posts shall be made by coping the pipe and continuously welding. All welds shall be ground smooth. Railing splices shall be butted and reinforced by a tight-fitting interior sleeve not less than 6" long.
- B. Railings and posts shall be clear anodized after fabrication.
- C. Aluminum toe plates shall be installed along all railings as shown on Contract Drawings.
- D. Railing Chains: Provide dual safety chains where shown on drawings, installed complete with swivel snap on one end and eye bolt on other end welded to railing post. Provide eye bolt welded to railing post for swivel snap. Chains shall be constructed of the same alloy as railings and links shall be 1/4 inch minimum in thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fastening to In-Place Construction:

1. Provide anchorage devices and fasteners where necessary for securing handrails and railing items to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
2. Use devices and fasteners that are compatible with aluminum.

B. Cutting, Fitting and Placement:

1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
2. Space posts 5 foot-6 inches on centers maximum and as shown.
3. Secure handrails to walls with wall brackets and end fittings as shown. Drill wall plate portion of the bracket to receive one bolt. Locate brackets as shown or, if not shown, at not more than 8 feet on centers. Provide flush-type wall return fittings with the same projection as that shown for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:
 - a. For concrete anchorage use bolt anchor expansion shields and lag bolts.

C. Protection from Dissimilar Materials:

1. Using bitumastic material, coat all surfaces of aluminum in contact with dissimilar materials such as concrete, masonry and steel. Coat posts one inch above slab, deck or walk.

3.2 CLEANING AND REPAIRING

A. Cleaning:

1. Remove all stains, dirt, grease or other substances by washing railings thoroughly using clean water and soap; rinse with clean water.
2. Do not use acid solution, steel wool or other harsh abrasive.
 - a. If stain remains after washing, remove finish and restore.

B. Repair:

1. Remove stained or otherwise defective Work and replace with material that meets specification requirements.

+ + END OF SECTION + +

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SECTION 05532

ALUMINUM GRATING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown, specified and required to provide aluminum grating and frames.
2. The Work also includes providing serrated grating to accommodate the Work under this and other Sections and attaching to the grating all items such as sleeves, bands, studs, fasteners and all items required including embedded angles for which provision is not specifically included under other Sections.

B. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM B 209, Aluminum Alloy Sheet and Plate.
2. ASTM B 210, Aluminum-Alloy Drawn Seamless Tubes.
3. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. NAAMM, Metal Finishes Manual, and Metal Bar Grating Manual.
5. Aluminum Association Standards.

- B. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the Work.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:

1. Representative samples of grating, appurtenances and other finished products requested by the Engineer. His review will be for type and finish only. Compliance with all other requirements is the exclusive responsibility of Contractor.

- B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
2. Setting drawings and templates for location and installation of anchorage devices.
3. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.
4. The Work shall not be fabricated until the Contractor submits field measurements of the openings and until the manufacturer's drawings based upon the Contractor's measurements have been approved by the Engineer. The manufacturer's drawings shall show all cutout locations.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. The manufacturer shall furnish grating conforming to the following criteria:

1. Design Loads: Uniform live load or a concentrated load on any area 24 inches square, whichever gives the greatest stresses.

<u>Live Load</u>	<u>Concentrated Load</u>
200 psf	1000 lbs

2. Maximum Clear Span Deflection: $1/180$ of span or $1/4$ inch, whichever is smallest.
3. Maximum Aluminum Fiber Stress: 12,000 psi.
4. Bearing bars shall be a maximum of $1-3/16$ inches on center, $3/16$ inches minimum thickness, and $1-1/2$ inches minimum depth, and are to be serrated.
5. Cross bars or bent connecting bars shall not exceed 4 inches on center.

2.2 MATERIALS

- A. Aluminum Bearing Bars: Alloy 6061-T6 conforming to ASTM B 221.
- B. Aluminum Cross Bars or Bent Connecting Bars: Alloy conforming to either ASTM B 221 or ASTM B 210.
- C. Aluminum Rivets: Aluminum-Alloy as recommended by the manufacturer.
- D. All supporting angles, structural sections, anchor straps and end bars shall be of 6061-T6 aluminum.
- E. Hardware:
 1. When joining aluminum treads, nosings and railings to aluminum or steel construction, Type 304 Stainless Steel Hardware shall be used.
- F. Aluminum stair treads and landings shall have same cross section and be of the same material as specified for aluminum grating.

2.3 FABRICATION

- A. Use materials of the minimum size and thickness as specified above unless shown otherwise. Work to the dimensions shown on approved Shop Drawings.
- B. Grating shall be as shown and shall comply with the NAAMM "Metal Bar Grating Manual", except as specified herein.
- C. Aluminum Grating may be welded or pressure locked.
- D. Grating shall be made up in panels to permit ease in removal and shall include any necessary structural aluminum support framing required to install a complete system. Grating in concrete shall be provided with aluminum angle frames having mitered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected to assure flush fit. Provide end-banding bars welded at about 4-inch on centers for each panel.
- E. Cutouts shall be provided where necessary for the passage of pipes, conduit and similar work. Where more than four bearing bars are cut, banding bars of the same dimensions as the bearing bar shall be provided around the opening and welded or electric forged to the grating.
- F. Grating shall be set with a full and uniform end bearing on the supports to preclude rocking movement. Wedges or similar shimming devices shall not be used. Aluminum clamps or clips shall be installed to anchor the grating to the supports. Provide minimum 4 saddle clips to fit 2 bearing bars, and 4 stainless steel stud bolts with washers, unless otherwise indicated.
- G. Provide serrated exposed surface.
- H. Type of Aluminum Finish: Clear anodized with a minimum coating of 0.0008 inch in accordance with Aluminum Association Standard A41.
- I. Product and Manufacturer: Aluminum grating shall be as manufactured by:

1. IKG - Borden Type FS.
2. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fastening to In-Place Construction: Use anchorage devices and fasteners to secure grating to supporting members or prepared openings, as recommended by the manufacturer.
- B. Cutting, Fitting and Placement:
 1. Perform all cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack. Do not use wedges or shimming devices.
 2. Making cutouts or openings in the grating in the field will not be allowed.
 3. Divide the panels into sections only to the extent required for installation wherever grating is to be placed around previously installed pipe, ducts, and structural members.
 4. Fit exposed connections accurately together to form tight hairline joints.
- C. Protection of Aluminum from Dissimilar Materials: Provide coating in accordance with Section 09900, Painting, on aluminum surfaces in contact with dissimilar materials.

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SECTION 05534

ALUMINUM FLOOR ACCESS HATCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide hinged, pressure resistant, aluminum floor access hatches as shown and specified.
2. The types of floor access hatches include the following:
 - a. Watertight and pressure resistant aluminum covers.
 - b. H-20 rated double leaf hatches with frames for drainage.

B. Related Work Specified Elsewhere:

1. Section 03300, Concrete.
2. Section 05504, Miscellaneous Metal Fabrications.
3. Section 15068, Small Diameter Piping, Valves and Specials.

1.2 QUALITY ASSURANCE

- A. Manufacturer: All aluminum access hatches for the project shall be the product of a single manufacturer. Covers from more than one manufacturer will not be permitted.
- B. Reference Standards: Comply with applicable provisions of Section 05504, Miscellaneous Metal Fabrications.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:

1. Shop Drawings showing dimensional plans of all floor covers, quantity schedule, details of fabrication and erection, drainage provisions and anchorage.

1.4 GUARANTEE

- A. Contractor shall furnish a written guarantee obtained from the manufacturer. Guarantee shall state the following:
 1. Covers are to operate properly and be free of defects in material and workmanship for a period of five years from date of purchase.
 2. Should any part fail to function, or break in normal use during this period, manufacturer shall furnish a new part at no charge to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General:
 1. Provide manufacturer's standard fabricated units, modified, if necessary, to comply with the requirements of the Drawings and Specifications. Where standard units are not available for the sizes and types required, custom fabricate units to match manufacturer's similar units.
- B. Pressure Resistant Clearwell Access Hatch:
 1. Provide cover leaf fabricated from 1/4-inch thick aluminum diamond plate. Cover shall be designed to accommodate 625 psf load rating with maximum allowable deflection of 1/150 of the span.
 2. Angle frame shall be fabricated from 1/4-inch thick raised curb style aluminum frame. Frame shall be installed with continuous gasketing to prevent air movement between clearwell and building interior under 4.5 inches w.g. clearwell pressure.

3. Hatch shall be provided with aluminum locking lugs welded to the frame and cover to work in conjunction with a recessed padlock and hasp (furnished by others).
4. Cover shall include stainless steel heavy duty hinges, tamper proof attaching hardware and automatic hold open arm with aluminum latch.
5. Cover shall be fabricated with stainless steel pressure locks.
6. Hatch shall be provided with a lifetime guarantee against defects in material and/or workmanship.
7. The pressure resistant clearwell access hatch shall be Model F1R series access hatch as manufactured by Halliday Products, Inc. Dimensions shall be as shown on the Drawings.

C. H-20 Rated Double Leaf Hatches:

1. The exterior hatches shall be of the double leaf type with size as noted on the Drawings.
2. The hatches shall be constructed to provide a 300-pound live load per square foot rating. The frame shall be of an aluminum extrusion with a continuous door stop and grout lip integral to it. The frame shall include a continuous aluminum angle support for the aluminum structural members of the door, which when totally embedded in the concrete slab will provide a H-20 rating. The door shall be reinforced with structural channel members a maximum of 6 inches on center designed to rest directly on the frame support angles when closed. The channel frame shall be minimum 1/4 inch thick.
3. Door leaves shall be 1/4-inch thick diamond aluminum plate (Type 6061-T6) with mill finish. Protect finish with a factory applied coating of lacquer standard with the manufacturer. Door leaves shall be equipped with fully enclosed and lubricated compression springs with the lower enclosing telescoping tube locked into a supporting "boot" firmly attached to the frame. Outer tubes of lifting mechanism shall be in the top position

attached to the door leaf to prevent moisture and debris from entering and being trapped between the tubes. The lifting mechanism shall be removable from cover and frame. Each door shall have an automatic hold-open, positive locking, device with a conveniently positioned release handle for easy, controlled, and safe closing.

4. Frames shall have anchor flanges or strap anchors where embedded in concrete and a stainless steel support angle where attachment is to the face of concrete.
5. Hardware shall be Type 304 or 316 stainless steel to include springs, tube, hold open arm, latch, guard chains, forged hinges and pins, and all fasteners.
6. Doors shall be designed such that any leaf can be opened by one man with a completely smooth and easy motion throughout the entire arc of operation.
7. Cover leafs shall have flush exterior locking device with removable handle, and interior turn handle.
8. Frames shall be furnished with drainable gutter style channels for drainage with 1 ½-inch drainage coupling.
9. H-20 rated double leaf hatches shall be model JD-AL, as manufactured by The Bilco Company or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with approved Shop Drawings.
- B. Set doors plumb, level and true to line or grade, without warp or rack, for anchoring under other Sections of these Specifications.
- C. Protection of Aluminum from Dissimilar Materials: Using approved asphaltic or zinc chromate paint, provide two heavy coats on aluminum surfaces in contact with

dissimilar materials such as concrete, masonry, steel and other metals.

- D. For covers with drainage frame, provide carbon steel piping. Drain piping shall be piped to the exterior wall with elbow down. Drain piping shall conform to Section 15068, Small Diameter Piping, Valves and Specials. Contractor shall furnish all necessary incidentals to connect drain piping to the frame.

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SECTION 05540

CASTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide all castings as shown and specified.
2. Castings include metal items which are not a part of the miscellaneous metal fabrications or metal systems in other Sections of these Specifications.

B. Castings shall include, but not be limited to, the following:

1. Manhole frames and covers.
2. Catch basin boxes, frames and grates.
3. Valve boxes and covers.
4. Clean out frames and covers.

C. Related Work Specified Elsewhere:

1. Section 02429, Drainage Structures.
2. Section 05504, Miscellaneous Metal Fabrications.
3. Section 09900, Painting.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM A 48, Gray Iron Castings.
2. ASTM A 536, Ductile Iron Castings.

- B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Shop Drawings for the fabrication and erection of all casting assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
 - a. Include setting drawings for location and installation of castings and anchorage devices.
 - 2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work.
 - 1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete in ample time to not delay that Work.
- B. Store materials to permit easy access for inspection and identification. Keep materials off the ground, using pallets, platforms, or other supports.

PART 2 - PRODUCTS

2.1 DETAILS OF CONSTRUCTION

- A. General:
 - 1. Design all frames, covers and grates to prevent rocking and rattling under traffic.

2. All castings shall be free from pouring faults, cracks, blow holes, or other defects affecting their strength and value for the service intended.
3. Castings shall be manufactured using tough, close-grained material without the admixture of cinder iron or metal of inferior quality. Angles shall be boldly filleted and the corners kept sharp and perfect.
4. No plugging of defective castings will be permitted.
5. Castings shall be fabricated true to pattern so that component parts fit together. The dimensions of all castings shall have a tolerance of plus or minus 1/16 inch and an additional tolerance of plus or minus 1/16 inch per foot of dimension. The weight deviation tolerance is 5%. Notwithstanding the above tolerances, all manhole frames, rings and covers of the same nominal size shall assemble interchangeably.

B. Drainage Manhole Frames and Covers:

1. Material: Cast iron conforming to ASTM A 48, Class 30.
2. Size: As shown on the Drawings.
3. Construction: All manhole castings shall be of the adjustable type and shall consist of an outer frame, inner frame, cover and a one-piece adjustment or filler ring. The flat exposed surface of the inner frame shall have a recessed pocket with the letters "ADJ." The top of this raised lettering shall be flush with the top of the frame. Bearing surfaces between frame and cover shall be machined, fitted together, and match marked to prevent rocking.
4. Product and Manufacturer: Drainage manhole frames and covers shall be as manufactured by:
 - a. Campbell Foundry.
 - b. Neenah.

c. E.L. LeBaron Foundry Company.

d. Or equal.

C. Access Manhole Frames and Covers:

1. Material:

a. Frame: Cast aluminum conforming to ASTM B 26.

b. Cover: Tenzaloy ZC-81A conforming to ASTM B 179.

2. Size: 24-inch diameter clear opening in the locations shown on the Drawings.

3. Construction: Heavy duty, watertight, provided with 3/4-inch diameter tubular gasket held in a cast groove in the cover for water tightness. Frame shall be provided with a square flange.

4. Product and Manufacturer: Watertight manhole covers and frames shall be as manufactured by:

a. Flockhart.

b. Neenah.

c. Or equal.

D. Catch Basin Boxes, Frames and Grates:

1. Material: Cast iron conforming to ASTM A 48 Class 30.

2. Size: As shown on the Drawings.

3. Construction: Heavy duty with machined bearing surfaces.

2.2 FINISH

A. Iron: Paint in accordance with Section 09900, Painting.

B. Aluminum: Provide mill finish.

C. Provide cast lettering as shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow manufacturer's printed instructions and approved Shop Drawings.
- B. Set castings accurately to required location, alignment and elevation, plumb, level, true and free of rock, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork.
- C. Protection from Dissimilar Materials:
 - 1. In accordance with Section 09900, Painting, coat all surfaces of aluminum in contact with dissimilar materials such as concrete, masonry, and steel or iron.

+ + END OF SECTION + +

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DIVISION 6 - WOOD AND PLASTIC

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SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, material, equipment and incidentals required to provide rough carpentry as shown and specified.
 - a. Provide openings in rough carpentry to accommodate Work under this and other Sections and building into the carpentry all items such as sleeves, anchor bolts, inserts and other items to be embedded in carpentry for which placement is not specifically provided under other Sections.
 - b. Provide pressure-treated wood roof rafters and all other wood components.
 - c. Provide openings in rough carpentry to accommodate the Work under other contracts and assist other contractors in building into the rough carpentry all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in rough carpentry under other contracts.
2. The extent of the carpentry work is shown on the Drawings.
3. The types of carpentry work required includes the following:
 - a. Pressure-treated wood roof rafters and all other wood components.
 - b. Plywood sheathing.
 - c. Lumber for temporary protection.

1.4 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Storage of Materials: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber, and provide air circulation within stacks.
- B. Handling Materials: Handle all treated products as specified in American Wood Preservers' Association, M4.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber, General:

- 1. Nominal sizes are shown, except as shown by detail dimensions. Provide actual sizes as required by American Lumber Standard Committee, National Grading Rule for Dimension Lumber PS-20, for the moisture content specified for each use.
 - a. Provide dressed lumber, S4S, unless otherwise shown or specified.
 - b. Provide seasoned lumber with 15 percent maximum moisture content at time of dressing.
- 2. Provide the following grade and species:
 - a. No. 2 Dimension Grade Douglas Fir - Larch (North), WWP.
 - b. No. 1 Dimension Grade Southern Pine, SPIB.

B. Plywood:

- 1. Exterior Type CC, Construction Grade, Group 1. (American Lumber Standard Committee, Plywood Standard, PS-1), APA rated for span with exterior glue CDX or better.
- 2. Interior Type BB-INT-DFPA Grade (American Plywood Association Trademark).

C. Accessories:

1. Nails, Spikes, and Staples: Galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations; size and type to suit application.
2. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations. Lab bolts and screws shall conform to ANSI/ASME B18.2.1.
3. Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Explosive actuated type anchors shall not be used.

D. Lumber for Protection and Temporary Support: Size and grades to meet applicable requirements of OSHA and structural requirements.

2.2 WOOD TREATMENT

A. Preservative Treatment: Where lumber is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Bureau (AWPB). Mark each treated item to comply with the AWPB Quality Mark requirements for the specified requirements.

1. Pressure-treat aboveground items with Alkaline Copper Quat (ACQ) or Copper Azole (CA-B) preservatives complying with AWPB (US-040. After treatment, kiln-dry to a maximum moisture content of 19 percent. Treat indicated items and the following:
 - a. Wood rafters bridging, cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry, plaster, or concrete.

- c. Plywood used as substrate for single ply adhered roofing system and all other exterior locations.
- B. Where items are cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the substrate and conditions under which the carpentry work is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 INSTALLATION

- A. General:

- 1. Discard units of material with defects which might impair the quality of the work, and units which are too small to fabricate the work with minimum joints or the optimum joint arrangement.
- 2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- 3. Securely attach carpentry work to substrates by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. Use common wire nails, except as otherwise shown. Make tight connections between members. Install fasteners without splitting of wood, predrill as required.

- B. Wood Grounds, Nailers, Blocking and Sleepers:

- 1. Provide wherever shown and where required for screeding or attachment of other work. Form to

shapes as shown and cut as required for true line and level of work to provide for solid attachment of finish work. Coordinate location with other work involved.

2. Attach substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
 3. Provide permanent grounds of dressed, preservative-treated, key-bevelled lumber not less than 1 1/2-inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- C. Wood Furring: Install plumb and level with closure strips at all edges and openings. Shim with wood as required for tolerance of finished work.
- D. Plywood Sheathing: Install over nailers and framing as shown.

3.3 TEMPORARY CONSTRUCTION

- A. Provide all lumber and accessories required for scaffolding, safety and protection of the work.
- B. Provide and install all temporary protection in accordance with applicable provisions of the Contract Documents, OSHA regulations, and as follows:
1. Temporary protection shall also include wood doors, railings, protection on floor or roof openings, temporary partitions, and the like; adequately maintained in good repair during the life of the Contract.
 2. Furnish and set temporary partitions with wood doors at all exterior doorways, exterior openings in exterior walls or in locations exposed to weather. These doors shall be substantially built and hung, equipped with proper hinges, locks and other necessary hardware, and shall be removed and reset whenever required to

accommodate the work of other Contracts and shall be kept in good repair at all times.

3. Provide substantial temporary wood covering over all openings left in roof for ducts, shafts, etc., using rough planking at least 2 inches thick, cleated together and otherwise made sufficiently strong and put in place wherever required.

+ + END Of SECTION + +

SECTION 06200

STRUCTURAL GLUED LAMINATED TIMBER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all glued laminated timber work as shown detailed on the contract drawings and specified herein.
- B. Structural glued laminated (glulam) timber is defined to include wood members fabricated from 1 inch or 2 inch nominal thickness lumber, glued face-to-face to a depth of three or more laminations.

1.2 SUBMITTALS

- A. Shop Drawings showing full dimensions of each member and layout of entire extent of glulam framing. Show large-scale details of connections, connectors, and other accessories. Indicate species and lamination combination, adhesive type, and other variables in required Work.
- B. Engineering design data and drawings signed and sealed by a licensed Professional Engineer licensed to practice in the State of New York. Original stamp and signature is required. No copies will be accepted. Design data must include calculations and drawings covering framing, beams, anchor bolts, etc., and shall show all forces, which the building may be exerted, on the roof beams.
- C. Product Data: Submit certification, indicating glued laminated timbers comply with requirements of ANSI/AITC A190.1-latest edition.

1.3 QUALITY ASSURANCE

- A. Standards: Comply with ANSI/AITC A190.1-latest edition.
- B. Manufacturer Qualification: Provide factory-glued structural units, produced by an AITC licensed firm

qualified to apply the AITC Quality Inspected mark, and qualified as a Certified Fabricator under AITC 115-2009. Manufacture of glued laminated timber shall be by:

1. Unalam, 18 Clifton Street, P.O. Box K, Unadilla, NY 13849.
 2. Or approved equal.
- C. Factory-mark each piece of glued laminated structural units with AITC Quality Inspected mark.
1. Place AITC mark on timber surfaces which will not be exposed in completed Work.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery and installation of glued laminated wood members to avoid extended on-site storage.
- B. Comply with provisions of AITC 111, "Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage, and Erection."

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED LAMINATED UNITS

- A. Lumber: Comply with ANSI/AITC A190.1 and applicable lumber association grading rules to obtain required design value.
- B. Preservative Treatment: When conditions of service indicate that pressure preservative treatment is needed, Unalam furnishes glued laminated timber with the following available treatments for exposed members and members with ground contact: CCA, Pentachlorophenol.
- C. All preservative treatments shall be treated prior to gluing per AWPA C28 Standard and AITC 109.
- D. Lumber Species: Southern Yellow Pine
- E. Adhesive: ANSI/AITC A190.1, wet use type.

- F. End Sealer: As soon as possible after cutting, a coat of end sealer shall be applied to the ends of all members.
- G. Penetrating Sealer: Manufacturer's standard translucent finish penetrating wood sealer that will not interfere with application of wood stain and transparent finish, or paint finish
- H. Appearance:
 - 1. AITC Premium - Knot holes and other voids over 1/16" shall be filled with clear wood inserts. The wide face of the members shall be clear. Corners of wide face shall be eased.
 - 2. AITC Architectural - Knot holes and other voids over 3/4" shall be filled with clear wood inserts. Corners of wide face shall be eased.
 - 3. AITC Industrial - Voids on the edges of laminations need not be filled. Corners of wide face need not be eased. Only the sides of the members are surfaced.
- I. Camber: Except as otherwise indicated, fabricate horizontal load bearing members with a camber as shown on the drawings.

2.2 STEEL CONNECTIONS & HARDWARE

- A. Provide hardware for joining glued laminated members to each other and to their supports, exclusive of hardware embedded in masonry or welded to structural steel.
- B. Steel shapes to receive one coat of rust inhibiting paint. Steel shapes exposed to weather shall be galvanized.
- C. Nuts and bolts shall be galvanized to prevent rust stains during erection.
- D. All steel shall be ASTM- A36, all nuts and bolts shall be ASTM- A307.

2.3 FACTORY FINISHING

- A. Factory applied penetrating sealer or factory finished with one (1) coat of manufacturer's standard color selection stain. Manufacturer will submit samples of finish for approval.

2.4 FACTORY APPLIED PROTECTION

- A. For Premium and Architectural Appearance Grades: Before shipping or exposing to outdoor conditions, bundle-wrap or individually wrap with manufacturer's standard, opaque, durable, water resistant, plastic-coated paper covering with water-resistant seams.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install miscellaneous steel connectors and accessories.
- B. Plan and execute erection procedures so that close fit and neat appearance of joints and structure as a whole will not be impaired. When hoisting members into place, use padded or non-marring slings.
- C. All members must be adequately braced until the complete structural system (all pertinent construction materials) has been installed.
- D. Correction of minor misfits and a reasonable amount of cutting, reaming, redrilling or alignment with drift pins will be considered a legitimate expense of erection.
- E. Handle and temporarily support members to prevent visible surface damage.
- F. Do not remove wrapping on individually wrapped members until it will serve no useful purpose, including protection from weather, soiling and damage from work of other trades.

SECTION 06611

FIBERGLASS REINFORCED PLASTIC GRATING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install fiberglass reinforced plastic grating and frames.
2. Attach all items such as sleeves, bands, studs, and fasteners to the grating.

B. Related Sections:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM C 581, Chemical Resistance of Thermosetting Resin Used in Glass Fiber Reinforced Structures.
2. ASTM D 635, Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
3. ASTM D 695, Compressive Properties of Rigid Plastics.
4. ASTM D 751, Coated Fabrics, Testing.
5. ASTM D 790, Flexural Properties of Plastics.
6. ASTM D 1501, Exposure of Plastic to Fluorescent Sunlamp.

- ###### B. Field Measurements:
- Take field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the Work.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. Representative samples of grating, appurtenances and other finished products if requested by Engineer. Review will be for type only. Compliance with all other requirements is the exclusive responsibility of Contractor.

B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
2. Setting drawings and templates for location and installation of anchorage devices.
3. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.
4. The Work shall not be fabricated until the Contractor submits field measurements of the openings and until the manufacturer's drawings based upon the Contractor's measurements have been approved by the Engineer.
5. Copies of manufacturer's complete color charts to be selected by the Owner.
6. Deviations from Drawings and Specifications.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Manufacturer shall furnish grating to conform the following criteria:

1. Design Loads: Uniform live load or a concentrated load on center of span, whichever gives the greatest stresses.

Live Load

300 psf

Concentrated Load

1000 lbs

2. Maximum Clear Span Deflection: $1/180$ of span or $1/4$ inch, whichever is smallest.
3. Bearing bars shall be a maximum of $1-3/16$ inches on center, and $1-1/2$ -inches minimum depth.
4. Cross bars shall not exceed 6 inches on center.
5. Flame Spread: 25 or less, ASTM E-84.

2.2 MATERIALS

A. Fiber Reinforcement:

1. Woven glass.
2. Finished Fabric, Chopped Strand Glass and Woven Roving: Uniform in color and characteristic of natural glass that has been cleaned and finished with chrome or silane complexes.

B. Plastic Resin:

1. Quality: High, industrial, general-purpose polyester.
2. Ultraviolet Blocking Agent: 0.25 percent maximum ultraviolet absorber.
3. Viscosity Control: 5% maximum thixotropic filler by weight.
4. Other Fillers: None.
5. Color: Dark Green (unless otherwise noted)

2.3 FABRICATION

- A. Use materials of the minimum size and thickness specified above unless shown otherwise. Work to the dimensions shown on approved Shop Drawings.
- B. Grating design shall consist of a structural modified I beam for main bars and a solid rod for cross bars.
- C. Main bars and cross bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

- D. Main bars and cross bars shall be manufactured by the Pultrusion process and shall incorporate the following minimal characteristics:
1. Greater than 60% glass reinforcement by weight, (approx. 50% by volume).
 2. Thorough wetting and coating of fibers, strands and bundles of glass reinforcement with resin.
 3. Precise positioning of reinforcement.
 4. Exert high pressure in the die to densify the composite, eliminate voids and porosity, and assure proper fiber/resin interfaces.
 5. Fully cured under constant tension.
- E. All intersections of main bars and cross bars shall be bonded with an epoxy adhesive.
- F. Grating shall be made up in panels to permit ease in removal. Grating in concrete shall be provided with fiberglass angle frames having mitered corners and welded joints. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected to assure flush fit. Provide end-banding welded at about 4-inches on centers for each panel.
- G. Cutouts shall be provided where necessary for the passage of pipes, conduit and similar work. Where more than four bearing bars are cut, banding bars of the same dimensions as the bearing bar shall be provided around the opening and welded to the grating. Bars not provided with banding bars shall have cut ends sealed.
- H. Grating shall be set with a full and uniform end bearing on the supports to preclude rocking movement. Wedges or similar shimming devices shall not be used. Stainless steel clamps or clips shall be installed to anchor the grating to the supports. Provide saddle clips to fit bearing bars, and stainless steel stud bolts with washers, unless otherwise indicated.
- I. Provide non-slip exposed surface.
- J. Fabricate all FRP exposed to outdoor conditions with an additional 1-MIL thick UV coating for UV protection.

K. Manufacturer: Provide fiberglass grating by one of the following:

1. Fibergrate Composite Structures, Inc.
3. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fastening to In-Place Construction: Use anchorage devices and fasteners to secure grating to supporting members or prepared openings, as recommended by the manufacturer.

B. Cutting, Fitting and Placement:

1. Perform all cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack. Do not use wedges or shimming devices.
2. Making cutouts or openings in the plate or grating in the field will not be allowed.
3. Divide the panels into sections only to the extent required for installation wherever grating is to be placed around previously installed pipe, ducts, and structural members.
4. Fit exposed connections accurately together to form tight hairline joints.
5. Provide additional supports, bracing, etc. where openings are cut in grating for passage of pipe to provide rigidity and prevent deflection and springing.

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DIVISION 7 - THERMAL AND MOISTURE PROTECTION

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SECTION 07112

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide dampproofing as shown and specified.
2. All cast in place concrete, excluding manholes, shall receive bituminous dampproofing.
3. The types of bituminous dampproofing required include the following:
 - a. Cold asphalt (nonfibrated) solvent based dampproofing.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the dampproofing.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: The applicator must have experience in this type of work and performed acceptable work on like projects of similar size.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. ASTM D 41, Primer for Use with Asphalt in Dampproofing and Waterproofing.
2. ASTM D 449, Asphalt for Dampproofing and Waterproofing.

3. ASTM D 491, Asphalt Mastic for use in Waterproofing.

4. FS SS-C-153, Cement, Bituminous, Plastic.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's instructions for surface preparation and application for review of Engineer.

B. Certificates: Submit for approval the following:

1. Copies of manufacturer's certification that bulk bituminous materials delivered to the project comply with the required standards.
2. Include statistical and descriptive data for each product. Certification shall list the dates of delivery, quantities, batch numbers and other statistical data.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver materials in manufacturer's original, unopened containers with labels intact and legible.
2. Deliver materials in sufficient quantity to allow continuity of work.

B. Storage of Materials:

1. Store in a manner which complies with fire and safety regulations.
2. Store emulsions at temperatures above 40°F.
3. Store materials on clean raised platforms with weather protective covering when stored outdoors.

1.5 JOB CONDITIONS

- A. Preparation: Do not proceed with dampproofing Work until the substrate has been properly patched and sealed or flashed to receive the dampproofing.
- B. Environmental Conditions:
 - 1. Do not apply membrane dampproofing on damp or frozen surfaces.
 - 2. Ensure temperatures are maintained at minimum 40°F for 24 hours before application and continuously until dampproofing membrane has cured.
 - 3. Provide ventilation when dampproofing in an enclosed space.
- C. Protection: Protect completed portions of dampproofing Work against damage by construction operations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold Asphalt Dampproofing Materials Solvent Type:
 - 1. Asphalt Compound: Manufacturer's standard asphalt and solvent compound, recommended for below-grade exterior and for above-grade interior applications' compounded to penetrate the substrate and build to a moisture-resistant, firm, elastic coating.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Hydrocide 648 by Sonneborn Building Products Division, Contech Incorporated.
 - b. Tex-Mastic No. 720 by J&P Petroleum Products, Incorporated.
 - c. Or equal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Contractor shall examine the substrates and the conditions under which the dampproofing shall be applied, and advise the Engineer in writing of unsatisfactory conditions. Do not proceed with the dampproofing Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 PREPARATION

- A. Clean the substrate of dirt, oil, loose materials and other substances which interfere with penetration, bond or performance of dampproofing materials.

3.3 INSTALLATION

- A. Cold Bitumen on Exterior Surfaces:

1. Prime substrate if recommended by manufacturer's instructions, using type and quantity of primer recommended by manufacturer.
2. Apply coat of liquid asphalt emulsion dampproofing material by spraying at the rate of 1.0 gallons per 20 square feet to produce a uniform dry film not less than 1/16 inch thick. Apply 2 coats if necessary to obtain required thickness, allowing time for complete drying between coats.
3. Fill all cracks, crevices and grooves. Make sure coating is continuous and free from breaks and pinholes. Spread around all joints, grooves, and slots and into all chases, corners, reveals and soffits.

+ + END OF SECTION + +

SECTION 07210

INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as required to provide insulation as shown and specified.
2. The extent of each type of insulation Work is shown on the Drawings or specified herein.
3. The types of insulation required include the following:
 - a. Molded Polystyrene insulation for concrete block walls.

B. Related Work Specified Elsewhere:

1. Section 04201, Unit Masonry Construction.
2. Section 06100, Rough Carpentry.

1.2 QUALITY ASSURANCE

- A. Design Criteria: Thermal Conductivity: The thicknesses shown are for the thermal conductivity, k-value at 75 degrees F., specified for each material. Provide adjusted thicknesses as directed for the use of material having a different thermal conductivity.
- B. Requirements of Regulatory Agencies: Comply with fire-resistance and flammability ratings as shown and specified; and comply with applicable requirements of the New York State Uniform Fire Prevention and Building Code.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following. except as otherwise shown or specified,

1. ASTM C 518, Thermal Conductivity of Materials by Means of Heat Flow Meter.
2. ASTM D 2842, Water Absorption of Rigid Cellular Plastics.
3. ASTM E 84, Surface Burning Characteristics of Building Materials.
4. ASTM E 119, Fire Tests of Building Construction and Materials.
5. FS HH-I-521F
6. FS HH-I-558B, Thermal Insulation.
7. FS HH-I-574B, Insulation, Thermal (Perlite).

1.3 SUBMITTALS

- A. Manufacturer's Data: Submit for approval copies of manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that the materials comply with specified requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver all materials in unopened undamaged original packaging bearing the manufacturer's labels.
- B. Storage of Material:
 1. Protect insulation materials from becoming wet or soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.
 2. Handle all materials with proper care to prevent damage from any source.

PART 2 - PRODUCTS

2.1 MOLDED POLYSTYRENE INSULATION

- A. Insulation inserts shall be expanded polystyrene, individually molded to have a minimum density of 1.3 lb./cu. ft. and a minimum R-value at 75°F of 3.92.
- B. Insulation inserts shall be installed in the cores of blocks in accordance with manufacturer's recommendations prior to delivery to the job site.
- C. All concrete unit masonry in exterior walls shall have insulation inserts.
- D. Product and Manufacturer: Insulation inserts shall be manufactured by:
 - 1. Concrete Block Insulating Systems - Korfil
 - 2. Or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the substrate and conditions under which the insulation Work is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the insulation Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the Project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.
 - 2. Apply insulation as required to fill voids of new concrete block walls (exterior walls only).

3.3 INSPECTION AND ACCEPTANCE

- A. Insulation which has become wet, damaged, or deteriorated, as determined by the Engineer, shall be promptly removed from the job. /

+ + END OF SECTION + +

SECTION 07220

SPRAYED INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Medium-density, polyurethane spray foam insulation.
- B. Related Sections:
 - 1. Section 06100 Rough Carpentry
 - 2. Section 06200 Structural Glued Laminated Timber
- C. Coordinate mechanical ventilation and fresh air supply with Mechanical sections and ASHRAE Guidelines for optimum indoor air quality.

1.3 REFERENCES

- A. American Society for Testing and Materials International (ASTM)
 - 1. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 2. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
 - 3. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials
 - 4. ASTM E 283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

1.4 SUBMITTALS

- A. Product Data for each type of insulation product specified.

- B. Product test reports performed by a qualified third-party testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, and other properties, based on comprehensive testing of current products.
- C. Evaluation Report: Evidence of compliance of foam-plastic insulations with International Building Code (IBC), International Residential Code (IRC), International Energy Conservation Code (IECC).
- D. Manufacturer's certificate certifying insulation provided meets or exceeds specified requirements.
- E. Installer's certificate showing the installation certification.
- F. Sample warranty

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Product produced in an ISO 9001 registered factory.
- B. Single Source Responsibility: Single source product from one manufacturer.
- C. Fire-Test-Response Characteristics: Provide materials specified as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84
- D. Toxicity/Hazardous Materials
 - 1. Provide products that contain no urea-formaldehyde
 - 2. Provide products that contain no PBDEs
 - 3. Provide products that are "Low-emitting"

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturers written instructions for handling and protection prior to and during installation.

- B. Store both components in a temperature controlled area between 65 and 85 degrees F. Do not allow product to freeze.
- C. Use only those components that are supplied by the Manufacturer.

1.7 PROJECT CONDITIONS

- A. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

1.8 WARRANTY

- A. Manufacturer's standard limited lifetime warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Polyurethane Spray Foam Insulation: ICYNENE MD-C-200™ by Icynene Inc.
- B. Or Approved Equal.

2.2 MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
- B. Spray Foam Insulation: Medium-density, conforming to the following:
 - 1. Thermal Resistance (for 1 inch of material) (R-Value/inch @75 deg F): ASTM C 518; 6.5 hr.sq ft.degree F/BTU
 - 2. Air Permeance (for 1 inch of material): ASTM E 283: <0.02 L/s.m² @75 Pa
 - 3. Water Vapor Transmission (for 1.5 inches of material): ASTM E 96; 0.9 perms
 - 4. Flame Spread and Smoke Developed Rating: ASTM E 84
 - a. Flame Spread: Less than 25
 - b. Smoke Development: Less than 450

C. Product Description:

1. ICC/ES Evaluation Report No. ESR 3199
2. Collaborative for High-Performance Schools (CHPS)
"Low-emitting material" per CA 01350 Criteria

2.3 SOURCE QUALITY CONTROL

- A. Product produced in an ISO 9001 registered factory.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
1. Review placement area to determine final location will not be within 3 inches of any heat source where the temperature will exceed 180 deg F per ASTM C 411 or in accordance with authorities having jurisdiction.

3.2 PREPARATION

- A. Clean substrates and cavities of loose materials capable of interfering with insulation placement.

3.3 APPLICATION

- A. Site mix liquid components supplied by manufacturer in accordance with manufacturer's written instructions.
- B. Apply insulation to substrates in compliance with manufacturer's written instructions.
- C. Apply insulation to produce thickness required for indicated R Value.
- D. Extend insulation in thickness indicated to envelop entire area to be insulated.
- E. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.4 REPAIRS

- A. Any repairs must be effected in accordance with the manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 07400

ALUMINUM SOFFITS AND FASCIAS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment for a complete installation of aluminum soffits and fascias, and related work shown on drawings and specified herein.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the aluminum siding work.

C. Related Work Specified Elsewhere:

1. Section 06100, Rough Carpentry
2. Section 07920, Caulking and Sealants

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. The installer shall be skilled and experienced in the type of aluminum siding work required, and equipped to perform workmanship in accordance with recognized standards.

B. Reference Standards: Comply with applicable provisions and recommendations of the New York State Code reference standards, as well as the indicated manufacturer's specifications, standards and recommendations.

1.3 SUBMITTALS

A. Samples: Submit for approval 12-inch long sample of specified soffit and fascia.

B. Shop Drawings: Submit for approval the following:

1. Shop drawings shown in the method and details of erection.
2. Copies of manufacturers Specifications.

1.4 PRODUCT DELIVERY AND HANDLING

A. Delivery of Materials: Deliver soffits and fascia boards to job in manufacturers original, unopened containers with labels intact and legible.

B. Storage of Materials:

1. Store materials in an area protected from construction traffic.
2. Store materials in same package in which they were shipped.

C. Handling Materials: Protect materials from dents, scratches, warps or bends.

PART TWO - PRODUCTS

2.1 MATERIALS

A. Soffit: Fully vented soffit.

B. Fascia: Solid aluminum fascia panels.

C. Accessories:

1. J-Channel, F-Channel and trim.

D. Colors: To be chosen by the Owner.

E. Product and Manufacturer:

1. Alcoa Building Products, Sidney, OH.
2. Or approved equal.

PART THREE - EXECUTION

3.1 INSTALLATION

- A. Prior to commencing work, verify governing dimensions of buildings; examine, clean and repair, if necessary, any adjoining work on which this work is in any way dependent for its proper installation.
- B. The field application of soffit, fascia and trim members shall be in accordance with the best practice, with all joint members true and plumb.
- C. Soffit, fascia and accessories shall be installed in accordance with the latest edition of the manufacturer's installation manual.
- D. Items not covered in this specification - as indicated on drawings or as required shall be provided for a complete installation.

3.2 WARRANTY

- A. Manufacturer to provide a lifetime limited warranty on the quality of materials.
- B. No service charge to inspect complaints.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 07461

FIBER CEMENT SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiber cement lap siding, panels, trim, fascia, molding and accessories

1.2 RELATED SECTIONS

- A. Section 04300 - Structural Brick
- B. Section 06100 - Rough Carpentry

1.3 REFERENCES

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets
- B. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.
- C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01342.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.
- D. Selection Samples: For each finish product specified,

two complete sets of color chips representing manufacturer's full range of available colors and patterns.

- E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 3. Refinish mock-up area as required to produce acceptable work.
 4. Size of mock-up shall be 4'W x 8'H, and include window/door flashing installation

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install

products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Product Warranty: Limited, non-pro-rated product warranty.

1. Lap siding, vertical siding, and soffit panels for 30 years.

B. Product Warranty: Limited, product warranty.

1. Boards for 15 years.

C. Finish Warranty: Limited product warranty against manufacturing finish defects.

1. When used for its intended purpose, properly installed and maintained according to manufacturer's published installation instructions, finish for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

D. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Email: request info (info@jameshardie.com); Web: www.jameshardiecommercial.com

B. Or equal

2.2 SIDING

A. HardiePlank HZ5 lap siding, HardiPanel, HardieSoffit HZ5 panels requirement for Materials:

1. Fiber-cement Siding - complies with ASTM C 1186

Type A Grade II.

2. Fiber-cement Siding - complies with ASTM E 136 as a noncombustible material.
3. Fiber-cement Siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
4. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
5. National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI, IBC, IRC).
6. City of Los Angeles, Research Report No. 24862.
7. Miami Dade County, Florida Notice of Acceptance 07-0418.04.
8. US Department of Housing and Urban Development Materials Release 1263d.
9. California DSA PA-019.
10. City of New York M EA 223-93-M.
11. Florida State Product Approval FL889.
12. Texas Department of Insurance Product Evaluation EC-23.

B. Trim:

1. HardieTrim HZ5 boards and HardieTrim HZ boards as manufactured by James Hardie Building Products, Inc.
2. HardieTrim HZ5 Fascia boards as manufactured by James Hardie Building Products, Inc.

2.3 FASTENERS

A. Masonry Walls (CMU):

1. Masonry Walls: Aerico Stud Nail, ET&F ASM No.-144-125, 0.14 inch (3.6 mm) shank by 0.30 inch (7.6 mm) head by 2 inches (51 mm) long corrosion

resistant nails.

2.4 FINISHES

A. Factory Primer: Provide factory applied universal primer.

1. Primer: Factory primed by James Hardie.
2. Topcoat: 2 layers - Refer to Section 09900 and Exterior Finish Schedule.

B. Factory Finish: Refer to Exterior Finish Schedule.

1. Product: ColorPlus Technology by James Hardie.
2. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
3. Process:
 - a. Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.
 - b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by third party.
4. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed.
5. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install a water-resistive barrier is required in accordance with local building code requirements.
- D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.
- E. Install siding manufacturer's weather barrier in accordance with local building code requirements.
- F. Use siding manufacturer's Seam Tape and joint and laps.
- G. Install siding manufacturer's flashing, and siding manufacturer's Flex Flashing

3.3 INSTALLATION - LAP SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

- D. Align vertical joints of the planks over framing members.
- E. Maintain clearance between siding and adjacent finished grade.
- F. Wind Resistance: Where a specified level of wind resistance is required lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.
- G. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION - BOARDS

- A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.
- E. Trim inside corner with a single board trim both side of corner.
- F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
- G. Allow 1/8 inch gap between trim and siding.
- H. Seal gap with high quality, paint-able caulk.
- I. Shim frieze board as required to align with corner

trim..

- J. Fasten through overlapping boards. Do not nail between lap joints.
- K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Trim boards to Trim boards.
- L. Shim frieze board as required to align with corner trim.
- M. Install Trim Fascia boards to rafter tails or to sub fascia.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07600

FLASHING, GUTTERS AND TRIM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide flashing and sheet metal Work as shown and specified. The Work also includes:
 - a. Providing openings in flashing to accommodate the Work under this and other Sections and building into the flashing all items such as sleeves, anchor bolts, inserts and all other items to be embedded in flashing for which placement is not specifically provided under other Sections.
 - b. Providing openings in flashing assisting other contractors in building into the flashing all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in flashing under other contracts.
2. The extent of the flashing and sheet metal Work is shown on the Drawings.
3. The types of flashing and sheet metal Work required include the following:
 - a. Coping and counter flashings.
 - b. Gutters and scupper flashing and leaders.
 - c. Flashing and counter flashing at penetrations in roofing.
 - d. Miscellaneous flashings not supplied by other Sections.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the flashing and sheet metal Work.

C. Related Work specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 04201, Unit Masonry Construction.
3. Section 07531, Single-Ply Adhered Roofing System.
4. Section 07920, Caulking and Sealants.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be skilled and experienced in the type of flashing and sheet metal Work required, and equipped to perform workmanship in accordance with recognized standards.

B. Design Criteria:

1. Except as otherwise shown or specified, comply with the recommendations and instructions of the manufacturer of the flashing and sheet metal being installed.
2. Flashing and sheet metal shall be permanently watertight, and not deteriorate in excess of manufacturer's published limitations.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM A 526, Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Commercial Quality.
2. ASTM B 29, Pig Lead.
3. ASTM B 32, Solder Metal.
4. ASTM B 101, Lead-Coated Copper Sheets.
5. ASTM B 370, Copper Sheet and Strip for Building Construction.

6. ASTM D 250, Asphalt-saturated Asbestos Felts for Use in Waterproofing and in Constructing Built-up Roofs.
7. FS 0-F-506C, Flux, Soldering, Paste and Liquid.
8. FS SS-C-153, Cement, Bituminous, Plastic.
9. FS QQ-L-201, Lead Sheet.

1.3 SUBMITTALS

- A. Samples: Submit for approval 12-inch square samples of specified metal to be exposed as flashing or sheet metal. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.
- B. Shop Drawings: Submit for approval the following:
 1. Shop Drawings showing the manner of forming, jointing and securing the metal to form flashings, gutters, downspouts, joint covers, copings, gravel stops and related sheet metal trim. Show joint details and waterproof connections to adjoining work and at obstructions and penetrations.
 2. Copies of manufacturer's specifications, installation instructions and general recommendations for flashing and sheet metal required. Include manufacturer's data substantiating that the materials comply with the requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver flashing and sheet metal materials to job or fabrication shop in manufacturer's original, unopened containers and rolls with labels intact and legible.
- B. Storage of Materials:
 1. Store materials in an area protected from construction traffic.
 2. Store materials in same package in which they were shipped.

- C. Handling of Materials: Protect flashing and sheet metal from dents, scratches, warps or bends.

1.5 JOB CONDITIONS

A. Scheduling:

1. Do not proceed with the flashing and sheet metal Work until curb and substrate construction, cant strips, blocking, and other construction to receive the Work is completed.
2. Schedule the installation of flashing and sheet metal to coincide with the installation of built-up roofing, waterproofing drains, piping, blocking, nailers, framing at openings, curbs, and other adjoining and substrate work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Flashing and Sheet Metal:

1. Stainless Steel Coping, Emergency Scupper Flashing, Counter Flashing and Sheet Metal: Provide sheet metal of Type 304 fully annealed and pickled, dead soft temper, No. 2B or 2D finish. Provide 26-gauge thickness except where heavier gauge is specified.
2. Emergency Scupper Pipe: 16-gauge stainless steel, soldered, watertight, as shown.
3. Lead Flashing and Sheet Metal: Provide sheet complying with the FS QQ-L-201, Grade S, and formed from common desilverized pig lead complying with ASTM B 29; weighing 4 pounds per square foot.

B. Gutters, Leaders and Downspouts:

1. Gutters shall be of seamless construction made on the job site. Gutters to be 6" aluminum with baked enamel finish (color to be selected by Owner) using 0.032" thick material. Hangers shall be bar type and submitted for approval.

2. Downspouts shall be 4" x 5" and manufactured of 0.027" thick aluminum, baked-on enamel finish to match gutters.
3. Aluminum flashing shall be as shown on the drawings and be made from 0.032" thick aluminum. Color to be selected by owner.

C. Emergency Scuppers: See Section 05504, Miscellaneous Metal Fabrications and Section 04201, Unit Masonry Construction.

D. Miscellaneous Materials:

1. Burning Rod for Lead: Same composition as lead sheet.
2. Solder for Steel, Lead and Copper: ASTM B 32, 50-percent tin and 50-percent lead, used with rosin flux.
3. Solder for Stainless Steel: ASTM B 32, 60 percent tin and 40 percent lead, used with acid-chlorine flux.
4. Nails, Screws and Rivets: Stainless steel, or as recommended by manufacturer of flashing sheet.
5. Cleats: Same metal and gauge as sheet being anchored, 2 inches wide, punched for two anchors.
6. Bituminous Coating: SSPC-Paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.
7. Sealants: Refer to Section 07920, Sealants and Caulkings.
8. Roofing-Cement: FS SS-C-153, Type I (asphaltic).
9. Roofing Felts: Asphalt saturated glass fiber felt complying with ASTM D 250.
10. Reglets: Provide springlock type reglets with windlock clips as follows:
 - a. Provide stainless steel, Type 304, 0.02-inch thick, for masonry, concrete and surface

installation with top flange 4 inches wide to penetrate the first wythe of brick.

- b. Product and Manufacturer: Provide one of the following:
 - a. Type SM, MA and CO by Fry Reglet Corporation.
 - b. Concrete, Masonry and Surface Types by Keystone Flashing Company.
 - c. Or equal.

2.2 FABRICATION

- A. Conform to quality, procedures and methods recommended by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated, unless otherwise shown or specified.
- B. Fabricated Metal Flashing: Shop fabricate sheet metal items to comply with profiles and sizes shown, and to comply with manufacturer's recommended details. Except as otherwise shown or specified, provide soldered flat-lock seams, and fold back metal to form a hem on the concealed side of exposed edges. Comply with metal producers' recommendations for tinning, soldering and cleaning flux from metal.
- C. Metal flashings, copings, counter flashings, etc., shall be formed of sheet metal as indicated on the Drawings.
- D. On all gutters provide completely shop fabricated corners; soldered to ensure watertight joints.
- E. Continuously welded emergency scuppers to form watertight seams.
- F. Make surfaces free of waves and buckles with lines, arises and angles sharp and true; curves shall be smooth.
- G. Materials furnished hereunder to be built into work by others shall be in condition for final installation. Do all cutting, fitting, drilling or other operation in sheet metal required to accommodate work of other trades. Provide any items essential to complete the

installation, though not specifically shown or specified, of the same kind, quality, and type as similar items utilized elsewhere in the building.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the substrate and the conditions under which the flashing and sheet metal Work is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with flashing and sheet metal Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 PREPARATION

- A. Before installing flashing and sheet metal, verify shapes, and dimensions to be covered.
- B. Prepare substrates as recommended by the sheet metal manufacturer.

3.3 INSTALLATION

A. General:

- 1. Separate dissimilar metals from each other by painting each metal surface in the area of contact with a heavy application of bituminous coating, or by other permanent separation as recommended by the manufacturers of the dissimilar metals. Comply with the following:
 - a. Separate stainless steel from dissimilar metals, including regular steel and iron, and from cementitious materials by a course of roofing felt wherever possible. Where felt application is not possible, coat the stainless steel or the other material with a 15-mil bituminous coating. Where felt is applied under sheets which will be soldered or welded. Cover felt with a course of building paper before installing stainless steel. Comply with manufacturer's recommendations for other forms of

protection of the stainless steel against corrosion.

2. Provide thermal expansion for running sheet metal, flashing, and other items exposed for more than 15 feet continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams as shown or, if not shown, at the following maximum spacings for each general flashing use:
 - a. Flashing and Sheet Metal: At 10-foot intervals, and 2 feet each side of corners and intersections.
3. Fabricate and install the Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat flat-locked seams with minimum exposure of solder, welds and sealant. Fold back the sheet metal to form a hem on the concealed side of exposed edges.
4. Conceal fasteners and expansion provisions wherever possible in exposed Work, and locate so as to minimize the possibility of leakage. Cover and seal work as required for a watertight installation.
 - a. Provide cleat-type anchorages for metal flashings and sheet metal wherever practical, arranged to relieve stresses from building movement, and thermal expansion and contraction.
 - b. Join parts with concealed rivets or sheet metal screws where necessary for strength or stiffness. Place sheets together before drilling.
 - c. In general, space nails, rivets, or screws not more than 8 inches apart. If nailing into concrete or masonry, use "Dryvins" and drilled holes.

5. On vertical surfaces lap two-piece flashings members a minimum of 3 inches.
6. On sloping surfaces, for slopes of not less than 6 inches in 12 inches, lap unsealed flashings a minimum of 6 inches. For slopes less than 6 inches in 12 inches, use soldered flat locked seams.
7. For embedment of metal flashing flanges in built-up roofing or composition flashing or stripping, extend flanges for a minimum of 4 inches embedment, and bed in roofing cement or other setting compound which is compatible with flashing, adjoining work and substrate.
8. Splice and Expansion Units: Use splice plates of same metal and gauge as the base material.

B. Installation of Stainless Steel Flashing and Trim:

1. Tin the edges of plain stainless steel to be soldered, for a width of 1 1/2 inches, using solder for stainless steel and acid flux. Remove every trace of acid flux residue from the metal promptly after tinning or soldering.
2. Provide welded joints. Provide upturned, 1/2-inch wide hooked flanges, and weld between adjoining sheets; lay seam flat.
3. Coordinate installation of roof expansion joint covers. See Section 07800, Roof Accessories.

C. Installation of Lead Flashing and Sheet Metal:

1. Where prefabricated units of lead flashing are to be set in felts the underside may be coated with flashing cement.
2. Cut and shape lead sheets in place with minimum of 1-inch lapped joints, and form bends and folds to provide corners and intersections as shown. Shave or wire-brush joint areas immediately before sealing joint. Burn joints in lead sheets to provide true welded construction, exercising care to avoid reduction of sheet thickness.

3. Use for flashing roof drains and vents.
- D. Coordinate installation of emergency scuppers and flashings with masonry.
 - E. Support and anchor each unit of Work in the manner shown; but in no case in a manner which would be inadequate for thermal expansion stresses and the normal loading of water, ice, wind and similar loadings.
 - F. On bituminous membranes, provide not less than 4 inches of mechanically-fastened cover over built-up base flashings.
 1. Overlap built-up base flashing with counter flashing a minimum of 4 inches and fold lower edge back on itself for 1/2 inch.
 - G. On all gutters provide completely shop fabricated corners to ensure watertight joints.
 - H. Continuously weld scuppers to form watertight seams.
 - I. Make surfaces free of waves and buckles with lines, arises and angles sharp and true; curves shall be smooth.
 - J. Materials furnished hereunder to be built into work by others shall be in condition for final installation. Do all cutting, fitting, drilling or other operation in sheet metal required to accommodate work of other trades. Provide any items essential to complete the installation, though not specifically shown or specified, of the same kind, quality, and type as similar items utilized elsewhere in the building.
 - K. Contractor shall examine the substrate and the conditions under which the flashing and sheet metal Work is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with flashing and sheet metal Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.4 ADJUSTMENT AND CLEANING

- A. Protect flashing and sheet metal until Final Acceptance of the Work.
- B. Do not permit workmen, or others, to step directly on flashing sheets in place, or to place or move equipment over flashing and sheet metal surfaces. Protect surfaces during installation of permanent covering Work and adjoining Work.
- C. Neutralize excess flux as Work progresses with 5 percent to 10 percent washing soda solution and rinse thoroughly.
- D. Clean exposed surfaces of every substance which is visible or might cause corrosion or prevent uniform oxidation of the metal surfaces. Exercise extreme care to remove fluxes and ferrous metal particles, including welding splatter and grinding dust.

+ + END OF SECTION + +

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SECTION 07610

PREFORMED METAL ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Work under this section includes furnishing and installing all materials and labor required for the new roof system. This includes but is not limited to the following: roof panels, clips, closures, flashing, vents, sealants, and other items required for a complete metal roof system.
2. The extent of roofing is shown on the Contract Drawings and/or in schedules.

B. Related Work Specified Elsewhere:

1. Section 07920, Caulking and Sealants.
2. Section 07210, Building Insulation.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Obtain primary materials of each type required from a single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Installer shall be authorized by the roofing manufacturer to install this product. Installer shall have a minimum of five (5) years and five (5) jobs of successful experience with metal roofing systems similar to the one specified here, on projects of similar size and scope.
- C. Metal roofing manufacturer's technical engineering department shall review and approve shop drawings prior to manufacture of metal roofing.
- D. Manufacturer's representative: a representative of the manufacturer, who is familiar with the design of the

roof system supplied, and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation to assure that the roof system meets the specified requirements. The manufacturer's representative shall be either an employee of the manufacturer with at least five years experience in installing the roof system or an employee of an independent installer that is certified by the manufacturer to have five years of experience installing similar roof systems.

E. Performance Criteria:

1. Provide wind uplift resistance in accordance with the 1994 Uniform Building Code.
2. Structural capacity of metal roofing system shall be determined in accordance with ASTM E 1592, the Standard Test Method for Structural Performance of Sheet Metal Roofing and Siding Systems by Uniform Static Air Pressure Difference. A minimum of two tested spans is required in order to interpolate allowable load data between tested spans. Extrapolation of data outside the tested spans is not allowed.
3. Provide a design analysis signed by a registered Professional Engineer, confirming that the structural capacity of the metal roofing system as determined in accordance with ASTM E 1592 is adequate to resist the above design loads in accordance with the 1994 UBC. Analysis should include calculations verifying the design loads, the uplift pressures and how those loads affect the various areas of the roof. Provide a roof plan with the perimeter areas of discontinuity clearly shown and distinguished from the typical field roof elements.
4. Air Infiltration: Panels shall meet the following standard when tested in accordance with ASTM E 1680-95: With Sidelap Sealant .0127 SCFM/sq ft @ 12 PSF.
5. Water Penetration: Panel shall meet the following standard when tested in accordance with ASTM E

1646-95: With Sidelap Sealant, no leakage @ 12 PSF.

6. Thermal Movement: All roof panels shall be secured to allow thermal movement. All flashing details shall also make provisions to allow for thermal movement.

1.3 WARRANTY

A. Manufacturer's Product Warranty.

1. Warrant for 20 years, following project delivery date, that panels will be free from defects, and that panels if properly installed will not rupture, fail structurally or perforate.

B. Installer's Warranty.

1. Warrant panels, flashing, sealants, fasteners, and accessories against defective workmanship, and to remain watertight and weatherproof with normal usage for two (2) years.

1.4 SUBMITTALS

- #### A. Submit shop drawings approved by the manufacturer's technical engineering department. Drawings shall be thorough and show all typical and special conditions including flashing, materials and thicknesses (gauges), all dimensions, all anchoring methods, sealant locations, sealant tape locations, and provisions for thermal movement and lines of fixity.

- #### B. Submit technical data, including installation instructions and recommendations for the following:

1. Metal Roofing System
2. Sealant Tape
3. Joint Sealing

- #### C. Calculations: Submit design analysis in accordance with 1.03 E.3.

- #### D. Test report: Submit copies of ASTM E 1592 structural capacity tests.

E. Submit documentation showing that the installer is authorized by the roofing manufacturer to install the roof product and that the installer has a minimum of five(5) years experience and five (5) jobs of similar scope to this job that were successfully completed.

F. Samples:

1. Submit three (3) samples of each type of fastener to be used.
2. Submit sample of closed cell foam closure.
3. Submit one (1) sample of each standard manufactured accessory.
4. Submit a sample of the roofing panel to be used showing the proposed profile.
5. Submit color sample(s).

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Keep coils and/or panels dry. If covered with plastic, provide ventilation.
- B. Protect against damage and discoloration. Handle panels with non-marring slings. Do not bend panels. Store panels with one end elevated for drainage. Protect panels against standing water and condensation between adjacent surfaces. If panels become wet, immediately separate sheets, wipe dry with clean cloth, and separate sheets for air-drying.

PART 2 - PRODUCTS

2.1 STEEL ROOFING:

- A. Preformed roof panels with field mechanically seamed and locked ribs, 2 inches high and 16 inches wide for steel panels or 12 inches wide for aluminum panels. Provide panels in full, unbroken, continuous lengths. Panel end laps are not permitted. Design is based on Ultra Seam US-200 as manufactured by Architectural Metal Products, Inc.

- B. STEEL- Base metal shall be 24 gauge steel conforming to ASTM A-653, Grade D with minimum yield strength of 50,000 PSI. Steel shall have a "Zincalume" or "Galvalume" protective coating conforming to ASTM A-792-83 consisting of 45% zinc by weight and 55% aluminum alloy by weight.
- C. Roof flashing: Flashing shall be from the same material, gauge, and finish as the roof panel. Temper of the flashing material may be reduced to facilitate fabrication.
- D. Pipe Flashing: Provide "Dektite" pipe flashing for metal roof penetrations as manufactured by Buildex, or equal. Flashing shall have the widest temperature range available. Other flashing shall be as detailed and required and shall match panels.
- E. Concealed Clips: Concealed clips shall be designed to meet the wind uplift requirements. Clips will provide for thermal expansion and contraction and will not abrade the panel against the clips, substrate, or fasteners. Clips are to be made from either stainless steel for aluminum applications or galvanized steel for steel applications.
- F. Clip Fasteners: Clip fasteners shall be either stainless steel for aluminum panel or galvanized steel for steel panel.
- G. Fasteners: All exposed fasteners are to be either stainless steel or galvanized hex head with neoprene washers painted to match the roofing color.
- H. End Closures: Provide waterproof, laminated, semi-rigid, cross-linked, polyethylene closed cell foam or neoprene. Closures shall tightly fit panel configuration.

2.2 FACTORY COLOR FINISH:

- A. Roof panels shall have a factory color finish on the exposed side. The exterior finish shall consist of a 70 percent polyvinylidene fluoride (Kynar 500) coating. Color shall be chosen from manufacturer's standard. The dry film thickness of the exterior coating shall be not less than 0.8 mil over a primer coat with a dry film thickness of 0.5 mil. The

exterior color finish shall meet the test requirements specified below. The manufacturer shall have conducted tests on previously manufactured sheets of the same type and finish as proposed for the project. Standard washcoat reverse.

- B. Salt Spray Test: A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of 10, no blistering, as determined by ASTM D 714; and rating of 7, 1/16-inch failure at scribe, as determined by ASTM D 1654.
- C. Formability Test: When subjected to a 180-degree bend over a 1/8-inch or 3t whichever is greater diameter mandrel in accordance with ASTM D 522, exterior coating film shall show no evidence of fracturing to the naked eye.
- D. Accelerated Weathering, Chalking Resistance, and Color Change: A sample of the sheets shall withstand a weathering test of a minimum of 2000 hours in accordance with ASTM G23 using a Type D apparatus, without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. After the 2000-hour weatherometer test, exterior coating shall not chalk greater than No. 8 rating in accordance with ASTM D4214 test procedures. After the 2000-hour weatherometer test, exterior coating color change shall not exceed 2 NBS units in accordance with ASTM D2244.
- E. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.
- F. Impact Resistance: Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in mils, express in inch-pounds, with no loss of adhesion.

- G. Abrasion Resistance Test: When subjected to the falling sand test in accordance with ASTM D 968 the coating system shall withstand a minimum of 60 liters of sand before the appearance of the base metal.
- H. Specular Gloss: Finished surfaces shall have a specular gloss rating of 30-35 or less at an angle of 60 degrees when measured in accordance with ASTM D 523.
- I. Pollution Resistance: Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Requirements: Preformed metal roofing shall be installed in accordance with manufacturer's written specifications.
- B. Roof panels shall run continuous with no horizontal joints.
- C. Roof panels shall be attached to structure by means of concealed anchorage system. No through penetrations or fasteners of roofing panels will be permitted except at eave, and for approved flashing attachments. Roofing anchor clips shall be spaced to meet design load requirements and approved engineering calculations.
- D. Locate concealed clips and fasteners in accordance with manufacturer's requirements and based on a registered structural engineer's recommendations for this specific project as specified for wind conditions.
- E. Field Forming of Panels: Roofing panels may be formed from factory-color-finished steel coils at the project site, in which case the same care and quality control measures that are taken in shop forming of roofing panels shall be observed.

- F. Secure panels without warp or deflection. Insure proper engagement of anchor clips with each panel rib before positioning next panel.
- G. Allowable erection tolerance: maximum alignment variation at 1/4 inch in 40 feet.
- H. Flashing: Details in installation which are not indicated shall be in accordance with NRCA Construction Details, SMACNA Architectural Sheet Metal Manual, AA Specifications for Sheet Metal Work, panel manufacturer's printed instructions and details and the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- I. Install work watertight, plumb, level and true with components securely attached and in accordance with manufacturer's recommendations.
- J. Treat any contacting surfaces of dissimilar materials to prevent electrolytic corrosion.
- K. Workmen who will be walking on roofing panels shall wear clean, soft-soled shoes that will not pick up stones or other abrasive material which could damage panel surfaces.
- L. Touch-Up: Touch-up damaged paint surfaces in accordance with manufacturers instructions.
- M. Cleaning and Repairing: At completion of each day's work and at work completion, sweep panels and flashing clean. Do not allow fasteners, cuttings, filings or scraps to accumulate on finish surfaces.

+ + END OF SECTION + +

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Work of this Section includes providing all roof accessories and appurtenant work as needed to construct a complete roofing system with the roof accessories.

B. Related Work Specified Elsewhere:

1. Section 07300, Roofing.
2. Section 07600, Flashing, Gutters and Trim.
3. Section 15855, Ventilation Equipment.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. National Roofing Contractors Association (NRCA).

1.3 SUBMITTALS

A. Shop Drawings:

1. Manufacturer's specifications, literature, and published installation instructions for each roof accessory, product, or system.
2. Shop drawings for each product showing materials, gauges, sizes, finishes, profiles, fabrication of special shapes, fasteners, and method of attachment to adjacent construction shall be submitted.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken, packages, containers, or bundles bearing the name of the manufacturer.
- B. Storage: Products shall be carefully stored on wood blocking in an area that is protected from all deleterious elements. Storage shall be a manner that will prevent damage or marring of the products and their finishes.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Roof accessories and their installation shall be in accordance with the manufacturer's literature and published specifications for the products indicated.
- B. Sizes indicated are minimum throat size.

2.2 SKYLIGHT

- A. Skylights shall be furnished as shown on the Contract Drawings and shall be located so as to provide lifting clearance for equipment mounted below.
- B. Manufacturer: Provide one of the following:
 - 1. Bilco GS-50.
 - 2. Or approved equal.

2.3 PREFABRICATED CURBS

- A. Opening dimensions shall be coordinated with sizes of roof-mounted equipment. Heights shall be as required to place top of curb not less than 8 inches above top of finished roof surface unless otherwise indicated. Top of curb shall be level unless otherwise indicated. Sides of curbs shall be adjusted in accordance with field conditions and roof slopes. Base flange shall be not less than 4 inches wide. Curbs shall be fabricated of 14 gauge or thicker galvanized steel

with continuously welded corners and shall be provided with a pressure preservative treated, kiln dried, fire-treated wood nailer at top. Roof curbs shall be foam insulated to provide minimum R-13 insulation value.

- B. Where possible, roof curbs shall be provided by the same manufacturer as the equipment being mounted.
- C. Manufacturer: Provide one of the following:
 - 1. TO BE DETERMINED.
 - 2. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. The installation shall conform to applicable codes and the manufacturer's published or written recommendations, specifications and installation instructions for the type of work being performed.
- B. All roof openings and roof-mounted equipment, shall be provided with a prefabricated curb unless the equipment above the roof opening is supplied with its own curb which extends to 8 inches or higher beyond the top of the finished roof surface.

3.2 INSTALLATION

- A. Skylights shall be installed over prepared openings with their own curb or a prefabricated curb, and shall be fastened to the roof deck in accordance with the manufacturer's printed directions. Lifting mechanisms and accessories shall be adjusted to insure proper operation. Abraded prime and finish coat surfaces shall be touched-up after completion of installation with the same type of finish and the same dry-film thickness.
- B. Roof accessory metal items exposed to the exterior atmosphere shall be painted with a protective coating complying with Section 09900.

+ + END OF SECTION + +

SECTION 07920

CAULKING AND SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide sealants and caulking as specified.
2. The types of sealant and caulking Work required include the following:
 - a. All metal to metal joints.
 - b. All joints between masonry and metal.
 - c. All control joints.
 - d. All joints between concrete members and masonry.
 - e. All locations whether or not indicated on the Drawings required to render the building watertight.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the sealants and caulking.
2. Coordinate the final selection of sealants and caulking to be compatible with all sealant and caulking substrates specified.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: The applicator must have experience in this type of work and performed acceptable work on like projects of similar size.
- B. Job Mock-ups:
 - 1. Prior to the installation of sealant and caulking Work, but after Engineer's approval of samples, install sample of each type of sealant and caulking in areas selected by the Engineer to show a representative installation of the sealants and caulking. Obtain Engineer's acceptance of visual qualities of the mock-ups before start of sealant and caulking Work. Retain and protect mock-ups during construction as a standard for judging completed sealant and caulking Work. Do not alter mock-ups.
 - 2. Sealant and caulking Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material, as required by the Engineer.
- C. Source Quality Control: Obtain materials from only manufacturers who will, if required:
 - 1. Send a qualified technical representative to the site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.
 - 2. Test sealants and caulking for compatibility with the substrates specified for conformance to FS-TT-S-0027, and recommend remedial procedures as required.
- D. Reference Standards: Comply with applicable provisions and recommendations, except as otherwise shown or specified.
 - 1. ASTM C 510, Test for Staining and Color Change of Single or Multicomponent Joint Sealers.
 - 2. ASTM C 661, Test for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

3. ASTM C 793, Test for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
 4. ASTM C 794, Test for Adhesion-in-Peel of Elastomeric Joints Sealants.
 5. ASTM C 790, Recommended Practices for Use of Latex Sealing Compounds.
 6. ASTM C 804, Recommended Practices for Use of Solvent-Release Type Sealants.
 7. Federal Specification, FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component for Caulking, Sealing, and Glazing in Buildings and Other Structures.
 8. Federal Specification, FS TT-S-001543, Sealing Compound, Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
 9. Thiokol Chemical Corporation, Standards for Polysulfide Sealants.
- E. Compatibility: Before purchase of each specified sealant, investigate its compatibility with the joint surfaces, joint fillers and other materials in the joint system. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation condition as shown by manufacturer's published data or certification.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Sample of each size and type of sealant backer rod, 12-inches long, as recommended by the sealant and caulking manufacturer.
 2. Sample of bond breaker tape as recommended by the manufacturer.

3. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

B. Manufacturer's Data: Submit for approval the following:

1. Copies of manufacturer's specifications, recommendations and installation instructions for each type of sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, indicating that each material complies with the requirements and is intended for the applications shown.

C. Test Reports: Submit for approval the following:

1. Compatibility tests for substrates, based on adhesion-in-peel standard test procedures and FS TT-S-0027.
2. Copies of certified laboratory test reports indicating conformance with the requirements specified.

D. Guarantee: Submit for approval the following:

1. Copies of written guarantee agreeing to repair or replace sealants which fail to perform as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver materials in sealant and caulking manufacturer's original unopened containers.
2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Formula or specification number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life and curing time when applicable.

3. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Engineer, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to the Owner.

B. Storage of Materials:

1. Store materials so as to preclude the inclusion of foreign materials.
2. Do not store or expose materials to temperature above 90°F or store in direct sunshine.
3. Do not use materials which are outdated as indicated by shelf life.
4. Store sealant tape in a manner which will not deform the tape.
5. In cool or cold weather store containers where temperature approximates 75°F for 16 hours before using.
6. When high temperatures prevail store mixed sealants in a cool place.

C. Handling:

1. Handle materials carefully to prevent inclusion of foreign materials.
2. Do not open containers or mix components until necessary preparatory work and priming has been completed.

1.5 JOB CONDITIONS

A. Environmental Conditions:

1. Do not proceed with installation of sealants and caulking under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

2. Proceed with the Work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.
 3. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
 4. When high temperatures prevail avoid mixing sealants in direct sunlight.
- B. Protection: Do not allow sealants and caulking to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant and caulking materials.

1.6 GUARANTEE

- A. Provide a written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data, as an inherent quality of the material for the exposure indicated. Provide guarantee period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Exterior and Interior vertical Joints:
1. Two-Component Urethane Sealant:
 - a. Urethane-based, 2-part elastomeric chemical curing sealant complying with the following:

- 1) FS TT-S-00227: Type 2 (non-sag) Class A.
 - 2) Adhesion-in-Peel, FS TT-S-00227 and ASTM C 794: Minimum 10 lbs/linear inch with no adhesion failure.
 - 3) Hardness (Standard Conditions), ASTM C 661: 24-35 (Shore A).
 - 4) Stain and color change, FS TT-S-00227 and ASTM C 510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C 793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120°F, FS TT-S-00227: No sag.
 - 7) Withstand repeated movement of up to 25 percent of joint width without failure.
 - 8) Minimum elongation at ultimate break point (ASTM D 412): 500 percent.
- b. Product and Manufacturer: Provide one of the following:
- 1) Sonolastic NP II by Sonneborn Division of Contech Incorporated.
 - 2) Sikaflex 2CNS by Sika Corporation.
 - 3) Dymeric by Tremco.
 - 4) Or equal.

B. Exterior and Interior Horizontal Joints:

1. Two-Component Polyurethane Sealant:

- a. Polyurethane-based, 2-part elastomeric sealant complying with the following:

- 1) FS TT-S-00227, Type 1 (self-leveling) Class A.
- 2) Water Immersion Bond, FS TT-S-00227: Elongation of 25% with no adhesive failure.
- 3) Hardness (Standard Conditions), ASTM C 661: 30-40.
- 4) Stain and Color Change, FS TT-S-00227 and ASTM C 510: No discoloration or stain.
- 5) Accelerated Aging, ASTM C 793: No change in sealant characteristics after 250 hours in weatherometer.

b. Product and Manufacturer: Provide one of the following:

- 1) Sonolastic Paving Joint Sealant by Sonneborn Division of Contech Incorporated.
- 2) Sikaflex 2CSL by Sika Corporation.
- 3) THC/900 by Tremco.
- 4) Or equal.

C. Provide colors selected by Engineer from sealant and caulking manufacturer's standard color charts. Manufacturers supplying sealants other than those specified above must provide the same colors available from those specified.

D. Miscellaneous Materials:

1. Joint Cleaner: Provide the type of joint cleaning compound recommended by the sealant and caulking manufacturer, for the joint surfaces to be cleaned.
2. Joint Primer and Sealer: Provide the type of joint primer and sealer recommended by the sealant and caulking manufacturer, for the joint surfaces to be primed or sealed.

3. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the caulking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant and caulking. Provide self-adhesive tape wherever applicable.
4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended for compatibility with sealant and caulking by the sealant and caulking manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.
5. Low Temperature Catalyst: Provide the type recommended by the sealant and caulking manufacturer.

2.2 MIXING

- A. Comply with sealant manufacturer's written instructions for mixing 2-component sealants.
- B. Thoroughly mix components before use.
- C. Add entire contents of activator can to base containers. Do not mix partial units.
- D. Mix contents for a minimum of 5 minutes or as recommended by the sealant manufacturer, until color and consistency are uniform.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor must examine the joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet,

and the conditions under which the sealant and caulking Work is to be performed, and notify the Engineer in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the sealants. Do not proceed with the sealant and caulking Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 JOINT SURFACE PREPARATION

- A. Clean joint surfaces immediately before installation of sealant compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bonds of sealant compound as recommended by sealant manufacturer's written instructions.
- B. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's written instructions indicate that alkalinity does not interfere with sealant bond and performance.
 - 1. Etch with 5 percent solution of muriatic acid.
 - 2. Neutralize with dilute ammonia solution.
 - 3. Rinse thoroughly with water and allow to dry before sealant installation.
- C. If necessary, clean porous materials such as concrete and masonry by grinding, sand blasting or mechanical abrading. Blow out joints with oil-free compressed air, or by vacuuming joints prior to application of primer or sealant.
- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.3 INSTALLATION

- A. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

- B. Prime or seal the joint surfaces wherever recommended by the sealant manufacturer. Do not allow prime or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to application of sealants.
- C. Apply masking tape before installation of primer, in continuous strips in alignment with the joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.
- D. Do not install sealants without backer rods or bond breaker tape.
- E. Roll the back-up rod stock into the joint to avoid lengthwise stretching. Do not twist, braid, puncture or prime backer-rods.
- F. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- G. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.
 - 1. For horizontal joints in sidewalks, pavements and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.
 - 2. For vertical joints subjected to normal movement and sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.

3. Install fire resistant sealants as recommended by sealant manufacturer to meet fire-rating requirements of the wall or floor.
- H. Remove excess and spillage of compounds promptly as the work progresses.
- I. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

3.4 FIELD QUALITY CONTROL

- A. Where questions of compatibility of sealants and substrate arise the contractor shall test the substrate in question for compatibility with the specified sealant and report his findings, with recommendations, to the Engineer. Any required sealant change shall be at no additional cost to the Owner.
- B. Do not proceed with installation of elastomeric sealants over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4-inch garden hose, without nozzle, held perpendicular to wall face, 2 feet-0 inch from joint and connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
- D. Test approximately 5 percent of total joint system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct test in the presence of the Engineer, who will determine the actual percentage of joints to be tested and the actual period of exposure to

water from the hose, based upon the extent of observed leakage, or lack thereof.

- E. Where nature of observed leakage indicates the possibility of inadequate joint bond strength, Engineer may direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures and returned to the lowest range of temperature in which it is feasible to conduct testing. Perform testing as directed at any time within 24 months of installation date.

3.5 ADJUSTMENT AND CLEANING

- A. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.
- B. Clean adjacent surfaces of sealant or soiling resulting from the Work. Use solvent or cleaning agent recommended by the sealant manufacturer. Leave all finish work in a neat clean condition.
- C. Protect the sealants during the construction period so that they will be without deterioration, soiling, or damage at the time of the Owner's acceptance.

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DIVISION 8 - DOORS AND WINDOWS

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SECTION 08100

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Under this section, the Contractor shall furnish all labor, materials and equipment necessary to furnish and install metal man-doors and frames as shown on the drawings and as specified herein.

B. Related Work Specified Elsewhere:

1. Section 08710, Finish Hardware.

1.2 SUBMITTALS

A. The following shall be submitted in accordance with Section 01342.

1. Manufacturer's Product Data.
2. Manufacturer's Installation Certification.
3. Dimensional Data.
4. Door Schedule.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Deliver doors and frames sufficiently in advance of its setting for proper inspection.
2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates; tagged to correspond with the approved door schedule.

B. Storage of Materials:

1. Provide secure lock-up for door and frame hardware stored at the site, but not yet installed.
2. Store doors and frames in manufacturers' original packages.

1.5 JOB CONDITIONS

- A. Scheduling: Deliver individually packaged doors and frames at the proper time to the proper locations for installation.
- B. Coordination: Coordinate door and frame installation with other work. Tag each item or package separately, with identification related to the door schedule, and include basic installations in the package. Furnish doors and frames of proper design for correct thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

PART 2 - PRODUCTS

2.1 STANDARD METAL DOORS AND FRAMES

A. General:

1. Metal doors and frames shall be installed in accordance with the Contract Drawings. The Contractor shall install hollow metal doors, frames, hardware, weather stripping and all accessories required for a complete installation.
2. Door and frame shall be factory fabricated from steel conforming to ASTM A1008, galvanized in accordance with ASTM A653 and A924. Doors shall have a 12 gauge galvanized steel face sheet in accordance with ANSI/SDI 250.8 and ANSI A250.4.
3. Frame shall have header and jambs of 12 gauge steel, mitered and welded at corners with all exposed welded joints ground smooth. A minimum of three wall anchors shall be provided per jamb as required for the adjoining wall construction. Jambs

shall be provided with clip angles for attaching frame to floor.

4. Anchors and clips shall not be less than 12 gauge steel. Frames shall be provided with 12 gauge temporary channel spreader. Header shall be provided with metal drip-cap.
 5. Doors shall be full flush construction 1-3/4-inch thick, with face sheet not less than 12 gauge steel, hot dipped galvanized. No seams or joints shall appear on door face and top and bottom shall be closed with a recessed channel or a flush end closure. Door shall be internally reinforced with 18 gauge vertical steel stiffeners spaced 6 inches apart and welded to face sheets every 5 inches to resist impact and to ensure flatness of finished surfaces. Fiberglass insulation material shall be applied to the interior of the door. The U-value of the completed door shall not be greater than 0.068. Door shall be provided with 12 gauge closer reinforcement.
 6. Cutting, reinforcing, drilling and tapping of door and frame shall be done at the factory, except drilling and tapping for surface applied hardware shall be done in the field. Door frame shall be prepared for silencer and rubber silencer shall be provided with concealed reinforcement for hardware such as hinges, lock, strike, door check arm, etc.
 7. Spring-tension type or integral-elastomeric type weather-stripping shall be provided for head and jamb protection. Weather-stripping for bottom of door shall be the concealed hook type of extruded aluminum compatible with the inter-locking threshold.
 8. Material for doors and frames shall be treated in the mill to ensure superior prime paint adhesion.
- B. Painting shall conform to the requirements of Section 09900 Painting.
- C. Doors shall be as manufactured by the Ceco Corporation, Oak Brook, IL., "Medallion" Extra Heavy Duty Commercial (Level 3) model, or approved equal.

2.2 DOOR SCHEDULE

<u>Location</u>	<u>Type</u>	<u>Size</u>	<u>From</u>	<u>To</u>	<u>Swing</u>	<u>Lock Set</u>	<u>Qty.</u>	<u>Wall Dimen.</u>
Packed Tower Building	Single	3'-0" x 8'-0"	Int.	Ext.	to Ext.	Yes	2	12"
Packed Tower Building	Double (2)	3'-0" x 7'-0"	Int.	Int.	to Int.	No	1	12"
Well 7A and 8A Building	Single	3'-0" x 6'-8"	Int.	Ext.	To Ext.	Yes	1	12"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of doors and frames and hardware shall comply with the manufacturer's specifications and recommendations.
- B. Doors and frames shall be set plumb, level, and true to line, without warp or rack of frames.

+ + END OF SECTION + +

SECTION 08360

ROLL-UP DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work in this Section includes upward-acting roll-up doors.
- B. Related work specified elsewhere:
 - 1. Section 05504 - Miscellaneous Metal Fabrications.
 - 2. Section 09900 - Painting.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of roll-up door. Include both published data and any specific data prepared for this project.
- B. Shop Drawings: Submit shop drawings for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.
- C. Manufacturer's written certification that the door has been installed according to their requirements.
- D. Manufacturer's 1-year warranty.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Roll-up doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of roll-up sectional doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.

- B. Installer: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.
- C. Single-Source Responsibility: Provide doors, frames, and accessories from one manufacturer for each type of door. Hardware shall be provided by the door manufacturer.
- D. Warranty: The roll-up door materials and hardware shall be guaranteed against defective workmanship for one year from the date of installation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Provide insulated steel roll-up doors by Overhead Door Corporation, Dallas, TX, 625 Series Stormtite; or approved equal.

2.2 INSULATED STEEL ROLL-UP DOOR

- A. Roll-up doors shall be provided in the sizes indicated on the drawings.
- B. Curtain slats shall be interlocking, roll-formed, fully foamed in place, insulated and flat profile. The front and back slats shall be fabricated from minimum 24 gauge galvanized steel conforming to ASTM A-525. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
- C. The bottom bar shall be two steel angles of 1/8 inch minimum thickness. The angles shall be fabricated of galvanized steel. The angles shall be bolted back to back in order to reinforce the curtain in the guides and shall be provided with a weatherseal.

- D. Guides shall be fabricated from three galvanized structural steel angles with a minimum thickness of 3/16 inches. Guides shall be weatherstripped with a vinyl weatherseal at each jamb, on the exterior curtain side. Guides shall be equipped with windlock bars as required to meet a minimum design windload of 20 psf.
- E. Brackets shall be 3/16 inch minimum galvanized steel plate to support the counterbalance, curtain and hood.
- F. Counterbalance shall be helical torsion springs designed for 20,000 cycles. The counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with a deflection limited to 0.03 inches per foot of span. The counterbalance shall be adjustable by means of an adjusting tension wheel.
- G. The hood shall be minimum 24 gauge galvanized steel. The hood shall be supplied with an internal hood baffle weatherseal.
- H. A manual chain hoist operator shall be provided.
- I. Lock shall be an interior mounted slide lock. Lock shall be a five pin tumbler keyed lock, keyed to the Owner's specifications.
- J. Curtain slats and hood shall be galvanized per ASTM A-525 and shall receive a rust-inhibitive, roll-coating process. Coatings shall include bonderizing, 0.2 mils thick baked-on prime paint, 0.6 mils thick baked-on polyester top coat. All non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate door frame fabrication and installation with pre-engineered metal building manufacturer to for allow proper installation.

3.2 PREPARATION

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Strictly comply with manufacturer's installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- B. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING AND CLEANING

- A. Test sectional doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

+ + END OF SECTION + +

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, material, equipment and incidentals required to provide finish hardware as shown and specified.
2. The extent of finish hardware is shown on the Drawings and in schedules. Finish hardware is defined to include all items known commercially as finish hardware, as required for swing doors, except special types of unique and unmatching hardware specified in the same Section as the door and door frame.
3. The types of finish hardware required include the following:
 - a. Mortise hinges.
 - b. Locksets.
 - c. Latchsets.
 - d. Door closers.
 - e. Stripping and seals.
 - f. Thresholds.
 - g. Miscellaneous items.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the finish hardware.

C. Related Work Specified Elsewhere:

1. Section 08100, Steel Doors, Frames and Hardware.

1.2 QUALITY ASSURANCE

- A. Supplier Qualifications: The finish hardware supplier shall have in his employ a member of the American Society of Architectural Hardware Consultants who shall be responsible for the complete finish hardware contract.
- B. Design Criteria:
1. Match the existing lock and latch set manufacturer and keying system, where applicable.
 2. Where the finish, shape, size or function of a member receiving finish hardware is such as to prevent the use of, or make unsuitable the types specified, furnish similar types having as nearly as practicable the same operation.
 3. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware for comparable openings.
 4. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.
 5. Contractor shall bring to Engineer's attention any item of finish hardware which cannot be installed or will not function properly.
 6. Unless otherwise specified, comply with the National Builders Hardware Association, "Recommended Locations for Builders Hardware."
 7. For fire rated openings, provide hardware complying with NFPA 80. Provide hardware which has UL approval for the intended use.
- C. Requirements of Regulatory Agencies:
1. Codes: Comply with the applicable requirements of the New York State Uniform Fire Prevention and Building Code for the types of finish hardware specified.

- D. Source Quality Control: To the greatest extent possible, obtain each type of finish hardware from only one manufacturer. Locksets, latch sets and cylinders must originate from the same manufacturer.
- E. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. FS TT-S-001657, Sealing Compound - Single Component, Butyl Rubber Based, Solvent Release Type.
 - 2. National Builders Hardware Association, Recommended Locations for Builders Hardware.
 - 3. NFPA Standard No. 80, fire doors and windows.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following, in accordance with Division 1:
 - 1. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.
 - 2. Copies of the finish hardware schedule, in the manner and format specified, complying with the actual construction progress schedule requirements (for each draft). Include a separate key schedule, showing clearly how the Owner's final instructions on keying of locks have been fulfilled. Finish hardware schedules are intended for coordination of the Work. Review and acceptance by the Engineer does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.
 - 3. Based on the finish hardware requirements specified, organize the final finish hardware schedule into "hardware sets," indicating complete designation of every item required for

each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other work (such as hollow metal frames) which may be critical in the Project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with Shop Drawings for other work, delivery schedules and similar information have been completed and accepted.

- B. Samples: Prior to submittal of the final hardware schedule and prior to delivery of hardware, submit one sample of each exposed hardware unit, finished as required, and tagged with full description for coordination with the schedule. Sample will be reviewed by Engineer for design, color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.
- C. Owner's Replacement Stock: Samples submitted which are approved by the Engineer will be forwarded to the Owner for use as replacement stock.
- D. Prepare a keying schedule in consultation with the Owner.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver finish hardware sufficiently in advance of its setting for proper inspection.
 - 2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with the approved finish hardware schedule.
- B. Storage of Materials:
 - 1. Provide secure lock-up for finish hardware stored at the site, but not yet installed.
 - 2. Store finish hardware in manufacturers' original packages.
- C. Handling of Materials: Control the handling and installation of finish hardware items which are not

immediately replaceable, so that the completion of the Work will not be delayed by finish hardware losses, both before and after installation.

1.5 JOB CONDITIONS

- A. Scheduling: Deliver individually packaged finish hardware items at the proper time to the proper locations for installation.
- B. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of hardware work to confirm that adequate provisions are made for the proper installation of hardware.
- C. Coordination: Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installations in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

1.6 SUBSTITUTIONS

- A. Do not make substitutions after Engineer's approval of final finish hardware schedule.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General:

- 1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.
- 2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates).

3. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.
4. Fasteners: Manufacture finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware which has been prepared for selftapping sheet metal screws, except as specifically indicated.
5. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.
7. No exposed fasteners on hardware units shall be visible when doors are closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.
8. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, removal and replacement of finish hardware.
9. Field Checks: Make periodic checks during installation of finish hardware to ascertain the correctness of the installation. After completion

of the work, certify in writing that all items of finish hardware have been installed, adjusted and are functioning in accordance with Specification requirements.

B. Mortise Hinges: Provide all doors with hinges as specified below:

1. Templates and Screws: Provide only template-produced units.
2. Base Metal: Except as otherwise specified, fabricate hinges from stainless steel and finish to match the latch and lock set.
3. Number of Hinges: Except as otherwise specified, provide two hinges on each door leaf of less than 60 inches and an additional hinge for each 30 inches or fraction thereof.
4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Interior Doors: Maximum 48 inches wide: 5-inch heavy weight (0.190 inch)
 - b. Exterior Doors: Maximum 48 inches wide: 6-inch heavy weight (0.203 inch).
 - c. All hinges for 1 3/4 inch thick doors shall be 4 1/2 inches wide in the open position. For other door thicknesses hinges shall be of width to permit unobstructed swing of the door.
5. Types of Hinges: Provide full-mortise type, ball-bearing hinges swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.
6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:
 - a. Pins: Non-rising stainless steel.

- b. Exterior Doors: Non-removable non-rising pins, modern type.
 - c. Tips: Flat button and matching plug with no horizontal lines, finished to match leaves.
- 7. Product and Manufacturer: Provide one of the following:
 - a. FBB 199H by The Stanley works.
 - b. T4B3386H by McKinney Manufacturing Company.
 - c. Or equal.
- C. Interior Mortise Style, Non-Keyed Passage Latch: Provide all interior doors with latch sets as specified below:
 - 1. Strikes: Provide manufacturer's standard wrought steel box strike, for each location and use shown. Provide curved lip strikes, unless otherwise recommended by manufacturer, finished to match latch set trim.
 - 2. Material: Provide all stainless steel chassis, including heavy-duty cylindrical case, latch case and front.
 - 3. Backsets: Provide backset of 2 3/4 inches.
 - 4. Modify specified locks and latches to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
 - 5. Finish: U.S. 32D satin on stainless steel.
 - 6. Operation: The latch bolt shall be retracted by knob from either side at all times.
 - 7. All locksets, etc., shall be of one manufacturer's products. Design shall be Schlage Mortise style or approved equal.
 - 8. Product and Manufacturers: Provide one of the following:
 - a. Schlage Series 1000, Model L9010.

b. Or approved equal.

D. Exterior Mortise Style, Keyed, Storeroom Set: Provide all exterior doors with lock and latch sets as specified below:

1. Material: Provide all stainless steel chassis, including heavy-duty cylindrical case, latch case and front.
2. Backsets: Provide backset of 2 3/4 inches.
3. Modify specified locks and latches to comply with UL, Building Materials Director, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
4. Finish: U.S. 32D satin on stainless steel.
5. Operation: The latch bolt shall be retracted by key outside or knob inside. The auxiliary latch shall deadlock the latch bolt when the door is closed. The inside knob shall be always free for immediate exit.
6. All locksets, etc., shall be of one manufacturer's products. Design shall be Schlage keyed mortise style, or approved equal.
7. Product and Manufacturers: Provide one of the following:
 - a. Schlage Series 1000, Model L9080
 - b. Or approved equal.

E. Cylinders and Keying System:

1. Multiple-Building System: Match Owner's master.
2. Equip all locks with manufacturer's standard 6-pin tumbler cylinder and provide Owner with four keys to match each tumbler assembly. All locksets shall be provided with either identical or independently keyed tumbler assemblies, as directed by Owner.
3. Each key shall be stamped "Do Not Duplicate."

Lockset: Mechanical pushbutton combination lock, with standard access control and key override, Unican Model LP 1020, Removable IC Core Arrow, Best, Falcon.

F. Door Closers:

1. Provide all doors both active and inactive, with door closers.
2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use. Use adjustable size closers, changeable from size 2 through 6 and reversible for right or left hand doors.
3. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.
4. Provide hold open feature for all doors except fire rated doors.
5. Provide long arm to allow door to swing 180 degrees where possible.
6. Provide individual regulating valves for closing and latching speeds, and separate adjustable backcheck valve, preset at 75 degrees.
7. Provide corner bracket on all exterior doors. Select arms to clear weatherstripping and overhead stops.
8. Material: Stainless steel.
9. Finish: US 32D Satin.
10. Product and Manufacturer: All closing devices and accessories are to be one manufacturer's products. Provide one of the following:
 - a. 1250 Series Door Closers by Sargent Division of Walter Kidde and Company, Incorporated.

- b. 1600SS Series Door Closers by Norton Security Products, Division of Scovill Industries.
 - c. Or equal.
- G. Floor Closers: All floor closers shall be furnished with gasket seals. Foundation cases shall be made of "Cycolac" and shall be impervious to acids, alkalis, salts, hydraulic oils and freezing temperatures.
- H. Overhead Stops:
 - 1. Provide heavy duty (30 pounds per square foot) overhead holder and stop with hold open feature on all exterior doors, both leafs. Comply with UL and NFPA requirements.
 - 2. Materials: Provide the following materials:
 - a. Shock Absorber Spring: Brass.
 - b. All Other Parts: Extruded bronze.
 - 3. Coordinate placement of overhead holder and stop with arm and bracket selection for door closers, for non-interference.
 - 4. Product and Manufacturer: Provide one of the following:
 - a. GJ 79HD Series Heavy Duty Overhead Door Holder by Glynn Johnson Corporation.
 - b. Or equal.
- I. Wall and Floor Stops:
 - 1. All doors shall have stops. Provide wall stops for all interior doors wherever possible. Provide floor stops only where conditions preclude the use of wall stops.
 - 2. Materials: Stainless steel or brass chassis with gray rubber tip.
 - 3. Finish: US 32D Satin or US26D Satin, as scheduled.

4. Provide concealed stainless steel fasteners as required by the substrate.
5. Coordinate height of dome type floor mounted door stops with threshold condition and undercut of door.
6. Product and Manufacturer: Provide one of the following (except where otherwise specified):
 - a. 408B wall-mounted concave series and 436 floor-mounted dome type series by Ives Company.
 - b. WB60MX wall-mounted concave series and 13X floor-mounted dome type series by Glynn Johnson Division of The Citation Companies.
 - c. Or equal.

J. Coordinators:

1. Provide coordinator device on all pairs of doors requiring automatic flush bolts. Comply with UL, List of Inspected Fired Protection Equipment and Material, and NFPA No. 80 requirements.
2. Provide manufacturer's standard carry bar and strike on all pairs of doors equipped with coordinator.
3. Materials: Bronze.
4. Finish: Polished bronze.
5. Product and Manufacturer: Provide one of the following:
 - a. 469 series by Ives Company.
 - b. COR 65 by Glynn-Johnson.
 - c. Or equal.

K. Stripping and Seals:

1. Provide perimeter weather stripping at all exterior doors and doors in walls forming hazardous spaces and as specified.

2. Continuity of Stripping: Except as otherwise specified, it is required that the stripping at each opening be continuous and without unnecessary interruptions at door corners and hardware.
3. Replaceable Seal Strips: It is required that the resilient or flexible seal strip of every unit be easily replaceable and readily available from stocks maintained by the manufacturer.
4. Provide bumper type weather stripping at jambs and head, including a resilient insert and metal retainer strip, surface applied, of the following metal, finish and resilient bumper material:
 - a. Housing: Extruded aluminum with medium bronze anodized finish; 0.062-inch minimum thickness of main walls and flanges.
 - b. Seals: Silicone or vinyl.
5. Product and Manufacturer: Provide one of the following:
 - a. No. 293AV by Pemko Manufacturing Company.
 - b. No. 129VDUR by Reese Enterprises, Inc.
 - c. Or equal.
6. Provide automatic drop-seal sound-stripping door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar, and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting on doors as follows:
 - a. Housing: Extruded aluminum, 0.062-inch thick, with medium bronze anodized finish on exposed surfaces.
 - b. Seal: Closed-cell sponge neoprene.
 - c. Mounting: Surface-mounted, except as otherwise indicated. Mount on stop-face of

doors, except mount on hinge-face of swing-in exterior doors.

7. Product and Manufacturer: Provide one of the following:
 - a. No. 430DS by Pemko Manufacturing Company.
 - b. No. 330DUR by Reese Enterprises, Inc.
 - c. Or equal.

L. Astragals:

1. Provide metal and neoprene astragal for exposed flat head screw mounting on both leaves of all pairs of doors.
2. Provide astragal of extruded aluminum, medium bronze anodized finish and black neoprene.
3. Product and Manufacturer: Provide one of the following:
 - a. No. 375DR Series by Pemko Manufacturing Company.
 - b. No. 93DUR by Reese Enterprises, Incorporated (with additional screws through neoprene).
 - c. Or equal.

M. Flush Bolts:

1. Provide flush bolts on the inactive leaf of all pairs of doors, at the top and bottom of door.
2. Materials: Provide the following materials:
 - a. Flush Bolt Levers: Aluminum.
 - b. Flush Bolt Plate: Aluminum.
 - c. Flush Bolt Guide and Strike: Wrought brass.
 - d. Flush Bolt Rods: 1/2-inch round rods, bronze, 12-inch minimum length.
 - e. Bolt Head: Brass.

3. All flush bolts furnished for labeled doors shall have UL approval.
4. Provide extension flush bolts with 3/4-inch throws and with top bolt not over 6 feet above finished floor. Provide bottom flush bolt 12 inches long.
5. Product and Manufacturer: Provide one of the following:
 - a. 458 Flush Bolt by Ives Company.
 - b. 298 Flush Bolt by Russwin, Division of Emhart Corporation.
 - c. Or equal.

N. Thresholds:

1. Provide thresholds on all exterior doors and doors in walls forming hazardous spaces and as specified on Door Schedule.
2. Metal: Extruded aluminum, smooth commercial finish.
3. Surface Pattern: Grooved tread, manufacturer's standard.
4. Provide countersunk aluminum screws and expansion shields.
5. Width: 5 inches wide and full width of opening.
6. Construction: Single piece complying with manufacturer's recommendations.
7. Profile: Provide manufacturer's standard flat unit with low profile. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.
8. Thickness: 1/8-inch minimum.
9. Product and Manufacturer: Provide one of the following:

- a. 272A and 157A by Pemko Manufacturing Company, for low profile.
- b. S406A and S512AO by Reese Enterprises, Incorporated.
- c. Or equal.

O. Silencers:

1. Provide silencers for all non-fire rated door frames. Refer to Section 08116, for number required.
2. Product and Manufacturer: provide one of the following:
 - a. No. 3446 by Sargent and Company.
 - b. No. 33 by Russwin, Division of Emhart Corporation.
 - c. Or equal.

P. Sealants: Provide butyl rubber sealant complying with FS TT-S-001657 for use with thresholds.

Q. Rain Drip:

1. Provide rain drip for all exterior doors not protected by an overhang.
2. Metal: Extruded medium bronze anodized aluminum.
3. Provide projecting leg of 2 1/2 inches.
4. Product and Manufacturer: Provide one of the following:
 - a. R201 DUR by Reese Enterprises Incorporated.
 - b. 142 by Zero Weatherstripping Company, Incorporated.
 - c. Or equal.

5. Push Plates and Pull Bars:

- a. All push plates shall be 14-gauge by 3-inch by 12-inch wrought plates with beveled edges.
- b. All pull bars shall be 3/8-inch by 1 1/4-inch by 6 3/8-inch bar, fastened to a back plate that matches the push plate.

2.2 HARDWARE FINISHES

- A. Provide matching finishes for finish hardware units at each door or opening, to the greatest extent possible. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture. All hardware and hinges shall have a US32D finish unless otherwise noted. All surface closers shall have a USP finish unless otherwise noted.

PART 3 - EXECUTION

3.1 GENERAL

- A. Approval: As soon as practical after award of General Construction Contract and before a hardware schedule is prepared, and before any hardware is ordered or delivered to the project, the Contractor shall submit to the Engineer for his written approval, copies of sample list, listing each of the different items of builders' finishing hardware and catalog cuts of each item proposed.

3.2 INSPECTION

- A. Contractor shall examine the substrate to receive finish hardware, and ascertain the conditions under which the Work will be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the finish hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.3 PREPARATION

- A. Templates: Within 10 days after receipt of the approved hardware schedule, the hardware supplier shall furnish finish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of finish hardware. Upon request, check the Shop Drawings of such other work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

3.4 INSTALLATION

- A. Installation of all hardware shall be in a manner which will eliminate cracks on surfaces which could allow the growth of biological life by providing crevices and joints which can collect moisture and germs.
- B. Mount finish hardware units at heights recommended in, "Recommended Locations for Builders' Hardware," by National Builders Hardware Association, except as otherwise specified or required to comply with governing regulations.
- C. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install finish hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed

mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

- G. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel which will not corrode in contact with the threshold metal.
- H. Set thresholds in a bead of butyl rubber sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

3.5 ADJUSTMENT AND CLEANING

- A. Adjust and check each operating item of finish hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.
- B. Final Adjustment: Where finish hardware installation is made more than 1 month prior to acceptance or occupancy of a space or area, return to the Work during the week prior to acceptance or occupancy, and make a final check and adjustment of all finish hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of finish hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.
- C. Instruct Owner's personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.
- D. Finish hardware which is blemished or defective will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other work.
- E. Continued Maintenance Service: Approximately 6 months after the acceptance of finish hardware in each area, the Contractor, accompanied by the representative of the latch and lock manufacturer, shall return to the

Project and re-adjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace finish hardware items which have deteriorated or failed due to faulty design, materials or installation of finish hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the finish hardware.

+ + END OF SECTION + +

SECTION 08800

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide glass and glazing as shown and specified.
2. The extent of glass and glazing work is shown on the Contract Drawings.
3. The types of glass and glazing required include the following:
 - a. Glazing exterior and interior doors.
 - b. Glazing exterior windows.

B. Coordination: Review installation procedures under other sections and coordinate the installation of items that must be installed with the glazing.

C. Related Work Specified Elsewhere:

1. Section 08100, Steel Doors, Frames and Hardware.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: The installer of the glass and glazing materials shall be a firm with documented experience in the application of the types of glass and glazing required.

B. Manufacturer Qualifications:

1. The manufacturer of the glass and glazing materials shall be a firm with documented experience in manufacturing the types of glass specified.
2. Obtain glazing materials from manufacturers who will, if required, send a qualified technical

representative to the project site for the purpose of advising the Contractor of proper procedures and precautions for the use of the materials.

C. Design Criteria: For glass size, type and thickness comply with the following:

1. The New York State Uniform Fire Prevention and Building Code.
2. Consumer Product Safety Commission, Part 1201, Safety Standards for Architectural Glazing Materials.
3. Glass manufacturer's recommended load tables.

D. Requirements of Regulatory Agencies:

1. Safety Glass: Comply with ANSI Z97.1, with label on each piece of glass as required.

E. Allowable Tolerances: Tempered and heat-strengthened glass; glass shall not exceed the following flatness tolerances (either face, any direction, any location except for 2-inch wide border area) based on ¼-inch glass thickness with inversely proportionate tolerances of other thicknesses:

1. For 12-inch run: 1/16-inch bow.
2. For 3-foot run: 1/8-inch bow.
3. For 7-foot run: ¼-inch bow.
4. For 10-foot run: 3/8-inch bow.

F. Source Quality Control: To the greatest extent possible, provide all glass and glazing materials from one manufacturer.

G. Reference Standards: Comply with applicable provisions and recommendation of the following, except as otherwise shown or specified.

1. Architectural Aluminum Manufacturers Association, AMMA 804.1

2. ANSI Z97.1, Performance Specification and Methods of Test for Safety Glazing Material Used in Buildings.
3. ASTM D1667, Sponge Made from Closed-Cell Polyvinylchloride, or Copolymers Thereof.
4. Consumer Product Safety Commission, Part 1201, Safety Standard for Architectural Glazing Materials.
5. FS-DD-G-451d, Glass, Plate, Sheet, Figured (Float, Flat, for Glazed, Corrugated, Mirror and Other Uses).
6. FS-DD-G-1403B, Glass, Plate (Float), Sheet, Figured, and Spandrel Component (Heat Strengthened and Fully Tempered)
7. FS-TT-S00227E (3), Sealing Compound, Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Types of Construction).
8. FS-TT-001543, Sealing Compound: Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
9. Flat Glass Marketing Association (FGMA), Glazing Manual.
10. U.L., Building Materials Directory.

1.3 SUBMITTALS

A. Samples:

1. Submit for approval 12-inch square samples of each type of glass required. Engineer's review of samples will be for color, texture and pattern only. Compliance with other requirements is the exclusive responsibility of the Contractor.
2. Submit 12-inch long samples of each color for each type of glazing sealant or gasket exposed to view. Install sample between two strips of material similar to or representative of channel surfaces where sealant or gasket will be used, held apart to

represent typical joint widths. Samples will be reviewed by Engineer for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

3. Other samples to be submitted include:

- a. Clips
- b. Tapes
- c. Gaskets
- d. Glazing compounds

B. Shop Drawings: Submit for approval copies of manufacturer's specifications, and installation instructions - for each type of glass, glazing sealant or compound, gasket and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

C. Certificates: Submit for approval certifications that all glazing materials subject to the applicable standards of the Consumer Product Safety Council, Safety Standard for Architectural Glazing Material are in compliance. The certification must be issued in conformance to procedures stated in the standard.

1.4 PRODUCT DELIVERY STORAGE AND HANDLING

A. Delivery of Materials: Deliver glass with manufacturer's labels intact. Do not remove labels until glass has been installed, inspected, and approved by the Engineer. Keep glass free from contamination by materials capable of staining glass. Deliver glazing compounds and sealants in manufacturer's unopened labeled containers.

B. Handling of Materials: Protect glass from edge damage at all times during handling and installation. Handling shall be kept to a minimum.

C. Storage: Store glass in a dry, well ventilated location at a constant temperature, maintained above dew point.

- D. All glass shall be protected from soiling, condensation and moisture of any kind.

1.5 JOB CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of liquid glazing sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitation for installation. Proceed with glazing only when forecasted weather conditions are favorable to proper cure and development of high early bond strength. Wherever channel action is affected by ambient temperature variations, install sealants only when temperatures are in the middle third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation or compression, and bond stress will not be excessive at extremely low or high temperatures. Coordinate time schedule to avoid delay of project.
- B. Check openings to verify that frames are plumb and true, square and secure. Clean surfaces to be sealed.
- C. Take field dimensions for cutting glass and fabricating units.

1.6 GUARANTEE

- A. Tempered and Wire: Submit copies of written guarantee agreeing to repair or replace glass which fails to perform as specified, including failure of hermetically seal due to faulty manufacturing of the unit, for a period of 10 years.

PART 2 - PRODUCTS

2.1 GLASS

- A. Tempered Glass:

- 1. Plate-glass, ANSI 1.97.1, FS-DD-G14-03B, Type I, Quality q3, which has been heat-strengthened by manufacturer's standard process to achieve a flexural strength of 1 1/2-times normal glass strength; clear, Class 1; 1/4-inch thick, except as otherwise shown or specified.

2. Product and Manufacturer: Provide one of the following:

- a. Herculite Clear by PPG Industries, Incorporated.
- b. Tuf-Flex Clear by Libbey-Owens-Ford Company.
- c. Or equal.

B. Clear Wired Glass:

- 1. FS-DD-G-451d, Type III, Class 1, Kind A (flat), Form 1, wired and both faces polished, Mesh ml, welded square; ¼-inch thick, except as otherwise shown or specified.
- 2. Product and Manufacturer: Provide one of the following:
 - a. Polished Plate Wire Glass by PPG Industries, Incorporated.
 - b. Polished Baroque by Libbey-Owens-Ford Company.
 - c. Or equal.

2.2 GLAZING SEALANTS AND TAPES

A. General:

- 1. Colors: Provide black or other natural color wherever no other color is available. Wherever material is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for the application shown.
 - a. Provide color selected by Engineer from manufacturer's standard colors to blend with adjoining surfaces.
- 2. Hardness shown and specified is intended to indicate the general range necessary for overall performance. Consult the manufacturer's technical representative to determine the actual hardness recommended for the condition of installation and use. Except as shown or specified, provide glazing

materials within the following ranges of hardness (Shore A, fully cured, at 75°F):

- a. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact of moving sash and doors.
 - b. Non-Elastomeric Compounds: (Shore A not applicable) 2 to 12 mm penetration for 5.0 seconds of penetrometer needle on nominally cured compound, ASTM D 2451.
3. Compatibility: Before purchase of the specified glazing materials, investigate compatibility with the channel surfaces, joint fillers and other materials in the glazing channel. Provide only materials and manufacturer's recommended variation of the specified materials which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.
 4. Provide size and shape of gaskets and pre-formed glazing units as shown, or, if not shown, as recommended by the manufacturer, either in his published data or upon consultation with his technical representative.
- B. Exterior One-Part Silicone Rubber Sealant: One-part silicone sealant, complying with the following:
1. FS TT-S-00230C, Type 2 (non-sag) Class A.
 2. Provide acid-type wherever both joint faces are metal, glass, plastic or other non-porous material.
 3. Dynamic Movement Capability, FS TTS-001543: 100 to -50 percent.
 4. Product and Manufacturer: Provide one of the following:
 - a. Spectrem 2 by Tremco.
 - b. 862 Architectural Silicone Sealant by Pecora Corporation.

c. Or equal.

- C. Vinyl Foam Glazing Tape: Closed cell, flexible, self-adhesive, non-extruding, polyvinylchloride foam tape, recommended by manufacturer for exterior, exposed, watertight installation of glass, with only nominal pressure in the glazing channel; comply with ASTM D1667.

2.3 MISCELLANEOUS GLAZING MATERIALS

- A. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used as recommended by the glass manufacturer.
- B. Spacers: Neoprene, 40-50 durometer hardness, with proven compatibility with sealants used as recommended by the glass manufacturer.
- C. Cleaners, Primers and Sealers: Type recommended by sealant, gasket and glass manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor shall examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed, and notify the Engineer in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 PERFORMANCE

- A. Watertight and airtight installation of each piece of glass and insulated panel is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and door) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

- B. Glass manufacturer's recommended glazing channel dimensions are intended to provide for necessary minimum bit on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. The Contractor is responsible for correct glass size for each opening, within the tolerances and necessary dimensions established.

3.3 INSTALLATION

A. General:

1. Comply with combined recommendation of glass window and sealant manufacturer and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise.
2. Comply with Flat Glass Marketing Association, Glazing Manual, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
3. Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections.
4. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
5. Do not attempt to cut seam, nip or abrade glass on-site, which is tempered, heat strengthened, or coated.
6. All measurements and size for the work shall be obtained and verified by the Contractor who shall be responsible for the correct and accurate fitting of all his/her work.
7. All glass shall be set in such a manner as to avoid possibility of breakage.

8. Rebates shall be thoroughly cleaned and shall have been prime coated before glass is set.
9. Glass shall be well bedded and back glazed and all surplus compound adjoining work, while still fresh. Compound shall be finished in true, even lines, neatly and smooth-faced. All glass shall be set in strict accordance with the manufacturer's printed directions.
10. All glass when set and glazed shall be free from rattle and all exterior glazing shall be executed in such a manner that the work will be watertight. Insulating glass shall be set in compliance with the manufacturer's instructions.
11. Glazing molds shall be removed and replaced in their correct locations in such a manner as not to mar molding or the screws securing same.
12. All glazing shall be done at the building after the work into which glass is to be set has been installed. All openings shall be properly marked after being installed to show that the openings have been glazed.

3.4 PREPARATION FOR GLAZING

- A. Clean the glazing channel, or other framing members to receive glass immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant and glass manufacturer.

3.5 GLAZING

- A. Tape and Sealant Glazing:
 1. Cut glazing tape to length and set against permanent stops. Install horizontal strips first, extending over width of opening, before applying vertical strips. Place setting blocks at quarter points. Remove paper backing from tape. Position glass on setting blocks and press against tape for full contact.

2. Place glazing tape on free perimeter of glass. Seal butt joints of tape with joint sealant.
3. Install removable stop, avoiding displacement of tape, and exert pressure on tape for full continuous contact. Caulk space above glazing tape to top of glazing stop. Tool exposed surfaces of caulking compounds to provide a substantial "wash" away from the glass.
4. Clean and trim excess glazing materials from the installation, and eliminate stains and discolorations.

3.6 ADJUSTMENT AND CLEANING

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength internal cohesive strength and surface durability.
- B. Contractor shall be aware of and comply with all procedures required for the protection of glass and glazing sealants and compound during the construction period, so that they will be without deterioration or damage, other than normal weathering, at the time of final acceptance of the work.
 1. Furnish to the Owner specific instruction on the precautions and provisions required to prevent glass damage resulting from the alkaline wash and concrete surfaces and similar sources of possible damage.
- C. Remove and replace glass which is broken, chipped, cracked, abraded imperfect, improperly set or damaged in other ways during the construction period, including natural causes, accidents and vandalism, without extra cost to the Owner.
- D. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.

- E. Wash and polish glass on both faces not more than 4 days prior to final acceptance of the work in each area. Comply with glass manufacturer's recommendations.

3.7 GLAZING SCHEDULE

- A. Tempered Glass: Vision panels in non-fire rated doors.
- B. Clear Wire Glass: Vision panels in fire rated doors.

+ + END OF SECTION + +

DIVISION 9 - FINISHES

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SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The General Contractor shall furnish all labor, materials, equipment and incidentals required to provide painting as shown and specified.
2. The extent of painting work may be determined by referring to the Drawings, site inspections and as described in this Section.
3. The Work includes the painting and finishing of all exposed new and some existing interior and exterior surfaces including, but not limited to the following:
 - a. Structural steel.
 - b. Exposed piping, fittings, valves and insulation.
 - c. All new equipment and associated piping.
 - d. Doors and frames.
 - e. Interior floors, walls and ceiling of new structures.
 - f. Exterior surfaces of new masonry construction.
 - g. Existing surfaces damaged or exposed by the Work.
 - h. All existing and new piping in the Well 7A and 8A Building and Aeration Building.
 - i. All work specified to be painted whether or not specifically listed herein.

4. Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under this and other sections of the Work.
5. The term "paint" as used herein means all coating system materials, which includes pretreatment, primers, emulsions, enamels, stains, varnishes, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
6. The exposed surfaces of all work shall be painted, whether or not colors are designated in any schedule, except where the natural finish of the material is specifically noted as a surface not to be painted. Unless otherwise noted, the term "exposed" as used herein means all items not covered with concrete. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.
7. All exposed structural steel appurtenances, as indicated by the contract drawings and the specifications, which are customarily painted, shall be painted with not less than one shop coat and two field coats, or one prime coat and two finish coats of the appropriate paint.
8. Structural and miscellaneous metals covered with concrete, shall only receive a primer compatible with the covering material.
9. Piping and equipment identification for all new piping and equipment.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be field painted in this Section.
2. Coordinate the painting of areas that are inaccessible once equipment has been installed.

3. Provide finish coats which are compatible with the prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Contractor shall be responsible for the compatibility of all shop primed and field painted items. Furnish information on the characteristics of the finish materials proposed for use to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Engineer in writing of anticipated problems using the coating systems as specified with substrates primed by others.
4. Manufacturers of equipment to receive finish coating in the shop shall submit color charts with shop drawings for color selection by the Owner.

C. Related Work Specified Elsewhere:

1. Section 07920, Caulking and Sealants.
2. Equipment markers in appropriate equipment section.

D. Painting Not Included: The following categories of Work are not included as part of the field-applied finish Work, or are included in other Sections of these Specifications or in other contracts.

1. Shop Priming: Unless otherwise specified, shop priming of structural metal, miscellaneous metal fabrications, other metal items and such fabricated components as shop-fabricated or factory-built heating and ventilating, instrumentation and electrical equipment or accessories shall conform to applicable requirements of Section 09900 but is included under the appropriate Sections of this Specification.
2. Prefinished Items: Unless otherwise shown or specified, do not include painting when factory finishing such as baked-on enamel, baked-on phenolic resin, porcelain, polyvinyl fluoride or other similar finish is specified for such items as, but not limited to, finished mechanical and

electrical equipment such as conduits, fans, light fixtures and distribution cabinets, aluminum doors and other equipment. Contractor shall be required to touch-up factory finished items with paint supplied by the item manufacturer. Contractor shall field paint damaged prefinished items as directed by the Engineer.

3. Metal surfaces of aluminum, stainless steel, chromium plate, bronze, copper, and similar finished materials will not require finish painting, unless shown or specified.
4. Operating Parts and Labels:
 - a. Moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, motor and fan shafts do not require finish painting unless otherwise specified.
 - b. Do not paint over any code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 - c. Remove all paint, coating or splatter inadvertently placed on these surfaces.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide products manufactured by one of the following:
 1. Carboline
 2. Tnemec
 3. Sherwin Williams.
 4. Or approved equal.
- B. Applicator Qualifications:
 1. Submit the name and experience record of the painting applicator. Include a list of utility or industrial installations painted, responsible

officials, architects, or engineers concerned with the project and the approximate contract price.

2. Painting applicators whose submissions indicate that they have not had the experience required to perform the Work will not be approved.

C. Source Quality Control: Obtain all materials from the same manufacturer unless otherwise approved. Obtain materials only from manufacturers who will:

1. Provide the services of a qualified manufacturer's representative at the project site at the commencement of Work to advise on materials, installation and finishing techniques.
2. Certify long term compatibility of all coatings with all substrates, both new and existing.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. ANSI/NSF Standard 61.
2. ANSI A13.1, Scheme for the Identification of Piping Systems.
3. Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers Engineers (Ten States Standards), Recommended Standards for Water Works - Latest edition, Painting of Water Works Piping for Public Water Supplies.
4. OSHA 1910.144, Safety Color Code for Marking Physical Hazards.
5. SSPC volume 2, Systems and Specifications, Surface Preparation Guide and Paint Application Specifications.

E. Manufacturer's Guarantee:

1. The identification signs and nameplates shall be guaranteed in writing by the manufacturer against color fading, chipping, corroding or any other

manufacturing defects for a period of ten (10) years.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. Paint samples for Engineer's review of color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Provide a listing of the material and application for each coat of each finish sample.
2. Piping and Equipment Identification:
 - a. Submit to the Engineer for approval each type of tag proposed and the manufacturer's standard color chart and letter styles. Tags shall have stamped on them the information shown on the valve schedules.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.
2. Copies of Contractor's proposed protection procedures in each area of the Work.
3. List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.
4. Copies of manufacturer's complete color charts for each coating system.
5. Pipe Markers: Copies of manufacturer's technical brochure, including color chart and list of standard markers.
6. Maintenance Manual: Upon completion of the Work, furnish copies of a detailed maintenance manual including the following information:
 - a. Product name and number.

- b. Name, address and telephone number of manufacturer and local distributor.
- c. Detailed procedures for routine maintenance and cleaning.
- d. Detailed procedures for light repairs such as dents, scratches and staining.

C. Certificates: Submit for approval the following:

- 1. Certificates stating that materials meet or exceed Specification requirements.
- 2. Certificate stating that all coatings are compatible with substrate specified, and factory or field applied prime coats.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information.

- 1. Name or title of material.
- 2. Manufacturer's stock number and date of manufacture.
- 3. Manufacturer's name.
- 4. Contents by volume, for major pigment and vehicle constituents.
- 5. Thinning instructions where recommended.
- 6. Application instructions.
- 7. Color name and number.

B. Storage of Materials:

- 1. Store only acceptable project materials on project site.

2. Store in a suitable location approved by the Paint Manufacturer and accepted by the Owner. Keep area clean and accessible.
3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations including the Occupational Safety and Health Act of 1970.

C. Handling:

1. All waste and paint rags shall be kept in tightly covered metal containers and the contents shall be safely disposed of at the end of each working day.
2. A sufficient number of approved type fire extinguishers shall be provided adjacent to the storage area.

1.5 JOB CONDITIONS

A. Existing Conditions:

1. Before painting is started in any area, it shall be broom cleaned and excessive dust shall be removed, and damp surfaces shall be dried.
2. After painting operations begin in a given area, broom cleaning will not be allowed; cleaning shall then be done only with commercial vacuum cleaning equipment.

B. Environmental Requirements:

1. Apply water base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.
2. Apply other paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 65°F and 95°F, unless otherwise permitted by the paint manufacturer's printed instructions.

3. Do not apply paint in snow, rain, fog, or mist or when the relative humidity exceeds 85 percent or to damp or wet surfaces.
 4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.
 5. Adequate illumination and ventilation shall be provided in all areas where painting operations are in progress.
 6. Install piping markers only after all painting and finish Work has been completed.
- C. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.
- D. Manufacturer's Field Service: A qualified representative of the manufacturer shall be available to instruct the painters on any special requirements or techniques for the application of the paints, coatings, etc., at no additional cost to the Owner. Prior to starting any painting, the Contractor shall supply, for use by the Engineer, two wet film thickness gauges and one dry film thickness gauge.

PART 2 - PRODUCTS

2.1 MATERIAL QUALITY

- A. Provide the best grade of the various types of coatings suitable for use in water supply and water treatment plants and as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. Provide primers produced by the same manufacturer as the finish coats. Use only thinners recommended by the paint manufacturer, and use only to recommended limits.

- C. Provide paints, and pipe markers of durable and washable quality. Use materials which will withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining, or other damage.

2.2 SUBSTITUTIONS

- A. No substitutions shall be considered that decrease the film thickness, the number of coats, the surface preparation or the generic type of coating specified. Approved manufacturers must furnish the same color selection as the manufacturers specified, including accent colors in all coating systems.
- B. No substitutions of paint containing volatile organic compounds (VOCs) shall be considered where paint is specified which does not contain VOCs.

2.3 COLORS AND FINISHES

- A. Surface treatments, and finishes, are specified under "Painting Systems" below. All substrates scheduled under "Painting Systems" shall be painted whether or not shown on the Drawings, or in Schedules, unless an item is specifically scheduled as not requiring the painting system scheduled below.
- B. Paint material coverage per gallon includes a 20 percent loss.
- C. Color Selection:
 - 1. Many different colors shall be selected for the Project, in addition to color coding of all piping.
 - 2. The Engineer reserves the right to select nonstandard colors for all paint systems specified within the ability of the manufacturer to produce such nonstandard colors. Selection of nonstandard colors shall not be cause for the Contractor rejecting Engineer's color selections and the Contractor shall supply such colors at no additional expense to the Owner.
- D. After approval of submittals and prior to beginning Work, the Engineer will furnish color schedules for

surfaces to be painted listed in the painting systems below.

- E. Color Coding: In general, and unless otherwise specified, all color coding of piping, and equipment shall comply with applicable standards of ANSI A13.1, OSHA 1910.144 and the Ten States Standards, Recommended Standards for Water Works, Current Edition.
- F. Color Pigments: Pure, nonfading, applicable types to suit the substrates and service indicated.
 - 1. Lead: Lead content shall not exceed amount permitted by federal, state and local government laws and regulations.
- G. All painting systems specified are based on brush application except as noted or specified. Other mechanical techniques shall be submitted to the Engineer for approval before these application techniques may be reflected in any paint schedules submitted by the Contractor. Submit proof of acceptability, of technique proposed, by the paint manufacturer selected.

2.4 PAINTING SYSTEMS

- A. Ferrous Metals and all Ferrous Piping; Interior Nonsubmerged:
 - 1. Surface Preparation: Blast Cleaning as specified in Section 3.2.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Carboline:
 - 1) Shop Primer: Carboguard 635 - 1 coat, 3.0-5.0 dry mils per coat, 180-330 square feet per gallon per coat.
 - 2) Field Primer or Field Touch-up: Carboguard 635 - 1 coat, 3.0-5.0 dry mils per coat, 180-330 square feet per gallon per coat.

- 3) Finish: Carboguard 890, 2 coats, 4.0-6.0 dry mils per coat, 200-300 square feet per gallon per coat.

b. Tnemec:

- 1) Shop Primer: V69 H.B. Epoxoline II - 1 coat, 3.0-5.0 dry mils per coat, 270-460 square feet per gallon per coat.
- 2) Field Primer or Field Touch-up: V69 H.B. Epoxoline II - 1 coat, 3.0-5.0 dry mils per coat, 270-460 square feet per gallon.
- 3) Finish: V69 H.B. Epoxoline II - 2 coats, 3.0-5.0 dry mils per coat, 240-360 square feet per gallon per coat.

c. Sherwin Williams:

- 1) Shop Primer: Copoxy Shop Coat Primer or Macropoxy 646 - 1 coat, 3.0-5.0 dry mils per coat.
- 2) Field Primer or Field Touch-up: Macropoxy 646 - 1 coat, 3.0 - 5.0 dry mils per coat.
- 3) Finish: Macropoxy 646, 2 coats, 3.0 - 5.0 dry mils per coat.

d. Or approved equal.

B. Ferrous, Nonferrous Metals, and Galvanized Metals;
Exterior Nonsubmerged:

1. Surface Preparation:

- a. Ferrous Metals: Blast Cleaning as specified in Section 3.2.
- b. Galvanized and Nonferrous Metal: Cleaning as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Carboline:

1) Primer:

- a) Ferrous Metals: Carboguard 635 - 1 coat, 3.0-5.0 dry mils per coat, 180-330 square feet per gallon per coat.
- b) Nonferrous and Galvanized: Sanitile 120 - 1 coat, 1.0-2.0 dry mils per coat, 300-350 square feet per gallon per coat.

2) Finish: Carbothane 134 - 1 coat, 2.0-2.5 dry mils per coat.

b. Tnemec:

1) Primer:

- a) Ferrous Metals: V69 H.B. Epoxoline II - 1 coat, 3.0-5.0 dry mils per coat, 270-460 square feet per gallon per coat.
- b) Nonferrous and Galvanized: None.

2) Intermediate: 66 H.B. Epoxoline - 1 coat, 4.0-5.0 dry mils, 240-360 square feet per gallon.

3) Finish: 73 Endura-Shield Aliphatic Polyurethane - 1 coat, 2.0-3.0 dry mils, 270-460 square feet per gallon.

c. Sherwin Williams:

- 1) Shop Primer: Copoxy Shop Coat Primer or Macropoxy 646 - 1 coat, 3.0-5.0 dry mils per coat.
- 2) Field Primer or Field Touch-up: Macropoxy 646 - 1 coat, 3.0-5.0 dry mils per coat.

- 3) Finish: High Solids Polyurethane, 1 coat, 2.5-4.0 dry mils per coat.

d. Or approved equal.

C. Galvanized Metal and Nonferrous Metals; Interior, Nonsubmerged:

1. Surface Preparation: Cleaning, as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Carboline:

- 1) Primer: Sanitile 120 - 1 coat, 1.0-2.0 dry mils, 300-350 square feet per gallon per coat.
- 2) Finish: Carboguard 890 - 1 coat, 4.0 - 6.0 dry mils, 200-300 square feet per gallon per coat.

b. Tnemec:

- 1) Primer: 66 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon.
- 2) Finish: V69 H.B. Epoxoline II - 1 coat, 2.5-3.5 dry mils, 240-360 square feet per gallon.

c. Sherwin Williams:

- 1) Primer: Macropoxy 646 - 1 coat, 2.0-4.0 dry mils per coat.
- 2) Finish: Macropoxy 646, 1 coat, 3.0-4.0 dry mils per coat.

d. Or approved equal.

D. Submerged or Intermittently Submerged Ferrous Metals; Interior and Exterior.

1. Surface Preparation: Cleaning, as specified in Section 3.2.
 2. Product and Manufacturer: Provide one of the following:
 - a. Carboline:
 - 1) Primer: Carboguard 635 - 1 coat, 3.0-5.0 dry mils per coat, 180-330 square feet per gallon per coat.
 - 2) Finish: Carboguard 891 - 2 coats, 4.0-6.0 dry mils per coat, 200-300 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: Series 22 - 1 coat, 12.0-15.0 dry mils per coat, 285-475 square feet per gallon per coat.
 - 2) Finish: Series 22 - 1 coat, 12.0-15.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Sherwin Williams
 - 1) Primer: Macropoxy 646 PW - 1 coat, 3.0 - 5.0 dry mils per coat.
 - 2) Finish: Macropoxy 646 PW - 2 coats, 3.0 - 5.0 dry mils per coat.
 - d. Or approved equal.
- E. All Aluminum in contact with Dissimilar Materials:
1. Surface Preparation: Remove all foreign matter. SSPC-SP1, solvent cleaned.
 2. Product and Manufacturer: Provide one of the following:
 - a. Carboline:

- 1) Carboguard 893SG - 2 coats, 4.0-6.0 dry mils per coat, 180-300 square feet per gallon per coat.

b. Tnemec:

- 1) V69 H.B. Epoxoline II - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.

c. Sherwin Williams:

- 1) Macropoxy 646- 2 coats, 3.0 - 5.0 dry mils per coat.

d. Or approved equal.

F. Ferrous Metals, Buried Exterior:

1. Surface Preparation: SSPC-SP 10, Near-White Blast, as specified in Section 3.2.
2. Product and Manufacturer: Provide one of the following:

a. Carboline:

- 1) Shop Primer: Carboguard 893SG - 1 coat, 3.0-5.0 dry mils per coat, 210-350 square feet per gallon per coat.
- 2) Field Primer or Field Touchup: Carboguard 893SG - 1 coat, 3.0-5.0 dry mils, 210-350 square feet per gallon per coat.
- 3) Finish: Bitumastic 300M - 2 coats, 8.0-10.0 dry mils per coat, 120-150 square feet per gallon per coat.

b. Tnemec:

- 1) Shop Primer: V69 H.B. Epoxoline II - 1 coat, 3.0-5.0 dry mils per coat, 270-460 square feet per gallon per coat.

2) Field Primer or Field Touchup: Surface preparation as specified.

3) Finish: Series 46H-413 H.B. Tneme-Tar - 2 coats, 8.0-10.0 dry mils per coat, 30-120 square feet per gallon per coat.

c. Sherwin Williams:

1) Shop Primer: Copoxy Shop Coat Primer - 1 coat, 3.0-5.0 dry mils per coat.

2) Finish: Hi-Mil Sher-Tar, 2 coats, 8.0 - 10.0 dry mils per coat.

d. Or approved equal.

G. New Interior Concrete Floors: Sealer shall be applied with 3/8"-3/4" nap lambswool or solvent resistant cover and not sprayed.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer:

a. H&L Silicone Acrylic Concrete Sealer by the Sherwin Williams Company (two coats).

H. Existing Interior Concrete Floors: Paint shall be applied with a brush or roller and not sprayed. Granules shall be added to the second coat to provide a skid resistant finish.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.

2. Product and Manufacturer: Provide one of the following:

a. Carboline:

1) Primer: Sanitile 600 - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.

- 2) Finish: Carboguard 890 - 2 coats, 3.0-5.0 dry mils per coat, 200-300 square feet per gallon per coat.

b. Tnemec:

- 1) Primer: V69 H.B. Epoxoline II - 2 coats, 3.0-4.0 dry mils per coat, 240-360 square feet per gallon per coat.
- 2) Finish: V69 H.B. Epoxoline II - 2 coats, 3.0-4.0 dry mils per coat, 240-360 square feet per gallon per coat.

c. Sherwin Williams:

- 1) Primer: Copoxy Shop Coat Primer - 1 coat, 3.0-5.0 dry mils per coat.
- 2) Finish: Macropoxy 646 - 2 coats, 3.0-5.0 dry mils per coat.

d. Or approved equal.

I. New and Existing Interior Concrete Block and Masonry Walls and Trim: Paint shall be applied with a brush or roller and not sprayed. Granules shall be added to the second coat on floors to provide a skid resistant finish.

1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.
2. Product and Manufacturer: Provide one of the following:

e. Carboline:

- 1) Primer: Sanitile 600 - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
- 2) Finish: Carboguard 890 - 2 coats, 3.0-5.0 dry mils per coat, 200-300 square feet per gallon per coat.

f. Tnemec:

- 1) Primer: Series 130 EnviroFill Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
- 2) Finish: V69 H.B. Epoxoline II - 2 coats, 3.0-4.0 dry mils per coat, 240-360 square feet per gallon per coat.

g. Sherwin Williams:

- 1) Primer: Heavy Duty Block Filler - 1 coat, 10.0 - 18.0 dry mils, 50-88 square feet per gallon.
- 2) Finish: Macropoxy 646 - 2 coats, 3.0-5.0 dry mils per coat.

h. Or approved equal.

J. New Exterior Masonry Clear Coating:

1. Surface Preparation: Remove Mortar and efflorescence as specified in Section 3.2.
2. Product and Manufacturer: Provide one of the following:
 - a. Hydrozo Clear Double 7 by Hydrozo Coatings Company (2 coats).
 - b. Thompson's Water Seal by E.A. Thompson Company (2 coats).
 - c. Or approved equal.

K. New and Existing Gypsum Wallboard, Exposed Finish Carpentry, Interior:

1. Surface Preparation:
 - a. Remove all foreign matter.
 - b. Fill voids created by securement devices with joint compound to achieve smooth surface.
 - c. Apply joint tape and joint compound to all lateral joints and at perimeter of ceilings.

- d. Sand joint compound with fine grit, open coated sandpaper to provide a smooth, flat surface. If additional joint finishing is required to provide a smooth, flat surface, the same joint compound or a ready mix spackling compound should be used.
 - e. Remove dust by wiping with clean rags.
2. Product and Manufacturer: Provide the following:
- a. Tnemec:
 - 1) Primer: Series 151 Elasto-Grip - 1 coat, 1.0-2.0 dry mils per coat.
 - 2) Finish: Series 113 or 114 H.B. Tnome Tufcoat - 2 coats minimum, 6.0-8.0 total dry film thickness.
 - b. Sherwin Williams:
 - 1) Primer: Loxon Conditioner - 1 coat, 2.0 - 3.0 dry mils per coat.
 - 2) Finish: Loxon - 2 coats, 3.0 - 4.0 dry mils per coat.
 - c. Or approved equal.

2.5 PIPING AND EQUIPMENT IDENTIFICATION

A. Identification Signs:

1. Lettering of Titles:

- a. Letter size shall be as indicated in the following table:

<u>Outside Diameter of Pipe or Covering</u>	<u>Size of Legend</u>
3/4-in to 1-1/2-in	1/2-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

- b. Letter type shall be Gothic Capital, upper case. Arrow shall match letter type and size. Colors of lettering and backgrounds shall match colors listed below.

2. Sign Materials:

- a. Signs and arrows shall be pressure sensitive vinyl tape with pressure sensitive vinyl tape banding. Banding in humid areas, as determined by the Engineer shall be stainless steel.
- b. Product and Manufacturer: Provide one of the following:
 - 1) Opti-Code Special Markers by Seton Name Plate Corporation.
 - 2) Custom Self-sticking Marker System by W.H. Brady Company.
 - 3) Or approved equal.

3. Titles for Equipment:

- a. Titles shall be provided on all equipment using 1-inch high letters same style and materials as specified above. Where more than one piece of the equipment item to be titled exists, the items shall be numbered consecutively as indicated on the mechanical drawings or as directed by the Engineer. Titles shall be composed in more than one line if required and justified on the left hand side as follows:

PUMP NO. "X"

- 4. Metal Tags: For valves and pipelines smaller than 3/4-inch in diameter, securely fasten metal tags, 2-1/2-inch by 1/2-inch, of 17 Birmingham Stubbs Gauge Brass with lettering etched and filled with enamel. Tags shall be approved by the Engineer.
- 5. Legend for Pipe Identification Signs: The identification signs shall have the following words

or abbreviations in the color combinations designated to identify the pipeline service.

<u>Service Line</u>	<u>Color Code</u>	
	<u>Lettering</u>	<u>Background</u>
Electrical Conduit	Black	Light Green
Well Casing Vent	White	Gray
Air Release Vent	White	Gray
Well Pump Discharge	White	Blue
Well Blow Off	White	Light Gray
Seal Water Drain	Black	Light Gray
Transfer Pump Discharge	Black	Light Gray
Booster Pump Discharge	Black	Light Gray
Tower Recycle	Black	Light Gray
Potable Water	White	Blue
Sodium Hypochlorite	Black	Yellow
Lime	Black	Yellow
Phosphate	Black	Yellow
Venturi Pressure Sensing Services	Black	Light Gray
Sampling Line	White	Blue

6. Legend for Nameplates:

- a. Nameplates for equipment and structures shall be in the same color combinations as the medium they service. Legends for nameplates shall follow the terminology designated.
- b. The nameplates shall include, but not be limited to, the following representative list of nameplate legends and appropriate color combinations to which the equipment identification numbers shall be added:

<u>First Line</u>	<u>Legend</u>	<u>Second Line</u>	<u>Color Code</u>	
			<u>Lettering</u>	<u>Background</u>
Well Pump 7A		--	White	Black
Well Pump 8A		--	White	Black
Flow Transmitter	Well 7A		White	Black
Flow Transmitter	Well 8A		White	Black
Pressure Transmitter		--	White	Black
Packed Tower 1		--	White	Black
Packed Tower 2		--	White	Black
Blower 1		--	White	Black

<u>First Line</u>	<u>Legend</u>	<u>Second Line</u>	<u>Color Code</u>	
			<u>Lettering</u>	<u>Background</u>
Blower 2		--	White	Black
Transfer Pump 1		--	White	Black
Transfer Pump 2		--	White	Black
Booster Pump 1		--	White	Black
Booster Pump 2		--	White	Black
Air Filters		--	White	Black
Clearwell 1	Access Hatch		White	Black
Clearwell 2	Access Hatch		White	Black

B. Additional Signs and Nameplates:

1. In addition to the legends specified herein the Engineer may order the Contractor to furnish and install additional identification signs, arrows and nameplates at no additional cost to the Owner. Such additional signs may be requested near completion of the Work and shall be limited to no more than 10 signs for each of the types specified. The legends and color combinations for additional signs shall conform to the requirements specified herein.

C. Legend for Valve Tags:

1. The Contractor shall be responsible for furnishing and installing tags for all valves required for his own work. Contractor shall submit to the Engineer a valve schedule containing all valves required for his work. The schedule shall contain for each valve, the location, type, a number, words to identify the valve's function, type of operator and the normal operating position. The information contained in the valve schedules shall be coded on the tags in a system provided by the Engineer. Each valve shall be coded and identified by the Engineer utilizing a combination of up to twelve letters and numbers.

D. Colors:

1. Standard Colors: Pipe line signs, equipment nameplates and finish coats of paint for pipe lines and equipment shall be coded in basic colors. Colors shall be brilliant, distinctive shades matching the following safety colors in accordance

with ANSI Z53.1 color specifications for safety colors and other basic colors as hereinafter specified.

TABLE OF STANDARD COLORS

<u>Color</u>	<u>Designation</u>
White	Safety
Yellow	Safety
Orange	Safety
Red	Safety
Black	Safety
Blue	Safety
Green	Safety
Gray	ANSI No. 61
Brown	*
Light Green	**
Charcoal	***

* The color "Brown" for paints shall be equivalent to Carboline 2277 or Tnemec Wild Cattail YB07.

** The color "Light Green" for paints shall be equivalent to Carboline 5384 or Tnemec Looking Glass GB52.

*** The color "Charcoal" for paints shall be equivalent to Carboline 2725 or Tnemec Black Thorn GR31.

2. Color of Pipe Lines:

a. All pipe lines and equipment shall be painted in conformity with the requirements of this section and the paint schedules contained on the drawings. The color of the final coats of paint shall be color coded.

b. General Color Code: Unless otherwise specified, the following color code should be used:

<u>Pipe Line</u>	<u>Color</u>
Well Pump Discharge	Gray
Transfer Pump Discharge	Gray
Booster Pump Discharge	Blue
Electrical Conduit	Gray
Vent Pipes	Gray
Lime	Light Green

Pipe Line

Color

Sodium Hypochlorite
Phosphate

Yellow
Light Green
w/Red Bands

Vents and drains shall be in the same color combination as the contents of equipment vented and drained.

- c. The color of the final coats shall match as closely as possible without custom blending, the color tabulated under Background for the specific pipe line service as given in the General Color Code tabulated previously.
- d. Where aluminum or stainless steel is specified for pipe, duct work or insulated jackets the exterior shall not be painted.
- e. Flanges, flexible couplings, valves and fittings shall be painted with the specified color code.

E. Spare Parts and Accessories:

- 1. Each contractor shall furnish the following spare parts and accessories:
 - a. For every 20 pipe identification signs installed:
 - 1) One complete mounting assembly.
 - b. For every 20 nameplates installed:
 - 1) One complete nameplate mounting assembly.
 - c. For every 20 valve identification tags:
 - 1) One stainless steel cable and splice.
- 2. All spare parts and accessories shall be suitably boxed and marked for storage and reordering.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Contractor and his applicator shall examine the areas and conditions under which painting Work is to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION

A. General:

- 1. Perform all preparation and cleaning procedures as specified herein and in strict accordance with the paint manufacturer's instructions for each particular substrate and atmospheric condition.
- 2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
- 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
- 4. No interior painting shall be started until the structure has been enclosed, ventilated and thoroughly dried out, as approved by the Engineer.

Apply materials under adequate illumination and ventilation. Special fans shall be provided when natural ventilation is insufficient and if required, face masks shall be provided for the painters. Written consent of the Engineer will be required before building fans may be used. Maintain temperature of rooms at 65°F. Minimum where varnish, lacquer or enamel is being applied and at 50°F. minimum during other painting and finishing. No exterior painting shall be started in rainy, snowy, damp or frosty weather, or until surfaces are thoroughly dry. Exterior painting shall be done only when air temperature is 40°F. or above and only in dry weather. Allow exterior paints and finishes to dry at least 48 hours between coats. Allow interior paints to dry at least twenty-four hours between coats. Allow enamels, lacquers and varnishes to dry at least forty-eight hours between coats. Dust well before succeeding coat is applied. Allow additional drying time if conditions warrant to assure that all coats are perfectly dry before applying succeeding coats. Remove or protect during painting all finish hardware, accessories, fixtures and similar items installed prior to painting and not required to be painted. If removed, carefully replace and adjust on completion of painting. All work shall be performed by experienced and competent painters in conformance with the requirements of the specifications.

5. All surfaces which were not shop painted or which were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted, as determined by the Engineer, shall be prepared as specified below.

B. Ferrous Metals:

1. Clean ferrous surfaces including structural steel and miscellaneous metal to be shop primed, of all oil, grease, dirt, mill scale and other foreign matter by near-white blast cleaning complying with SSPC-10.
2. Clean submerged ferrous surfaces including structural steel and miscellaneous metal to be shop

primed, of all oil, grease, dirt, mill scale and other foreign matter by white blasting complying with SSPC-SP 5.

3. Clean non submerged, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by near white blast cleaning, complying with SSPC-SP 10.
4. Clean submerged ferrous surfaces that have not been shop-coated or that, in the opinion of the Engineer, have been improperly shop coated, of all oil, grease, dirt, mill scale and other foreign matter by white blasting complying with SSPC-SP 5.
5. Treat bare and blasted or pickled clean metal with metal treatment wash coat, prior to priming only if recommended by the paint manufacturer.
6. Touch-up shop-applied prime coats which have damaged or bare areas, with primer recommended by the coating manufacturer after commercial blasting complying with SSPC-SP 6.
7. Ferrous metals with existing coatings shall be prepared as specified in Section 3.2.7.

C. Nonferrous Metals Surfaces: Clean nonferrous surfaces in accordance with the coating system manufacturer's instructions for the type of service, metal substrate, and application required.

D. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with a nonpetroleum based solvent, recommended by the coating manufacturer, complying with SSPC-SP 1.
2. Do not use chromate treatments on galvanized surfaces to be painted. Remove all chromate treatments by sanding or by other techniques as recommended by the paint manufacturer at no additional cost to the Owner.

E. Ferrous Surfaces with Existing Coatings:

1. General: All grease, oil heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.
2. Abrasive Blast Cleaning: The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.
3. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.
4. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

3.3 MATERIALS PREPARATION

A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's directions.
2. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by the manufacturer's instructions.
3. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a

clean condition, free of foreign materials and residue.

4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

3.4 APPLICATION

A. General:

1. Apply paint by brush or roller. Other mechanical application techniques such as air spray, or airless spray in accordance with the manufacturer's directions and recommendations of Paint Application Specifications No. 1 in SSPC Vol. 2, where applicable shall be used only as approved by the Engineer. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.
2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.
3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense primary accent colors. Insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
4. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise specified.
5. Paint aluminum parts in contact with dissimilar materials as specified with appropriate primer.

6. Omit field primer on metal surfaces which have been shop primed; touch-up paint shop prime coats only when approved by Engineer.

7. Use of thinners at any time shall have approval of the paint manufacturers.

B. Heating, Ventilating and Electrical Work:

1. Ventilating items to be painted include, but are not limited to, the following:

a. Hangers and supports.

b. Motors, mechanical equipment and supports.

c. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

a. Switchgear, panels, junction boxes, motor control centers, motors and accessories.

C. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, and provide total dry film thickness as specified. Apply extra coat if required to obtain specified total dry film thickness.

D. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

E. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat

with no burn-through or other defects caused by insufficient sealing.

- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
- G. Brush Application:
 - 1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.
 - 2. Brush apply all primers and first coats, unless otherwise permitted to use mechanical applicators.
- H. Mechanical Applicators:
 - 1. Use mechanical methods for paint application when permitted by governing ordinances, paint manufacturer, and approved by Engineer. If permitted, limit to only those surfaces impracticable for brush applications.
 - 2. Limit roller applications, if approved by the Engineer, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
 - 3. Confine spray application to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and to other surfaces specifically recommended by paint manufacturer.
 - 4. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.
- I. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work

3.5 PROTECTION

- A. Furnish and lay drop cloths in all areas where painting work is being done to protect floors and all other adjacent work and materials from defacement.
- B. Protect work of other trades, whether to be painted or not, from the Work of this Section. Leave all such work undamaged. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to the Engineer.
- C. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this contract and other contracts after completion of painting operations.

3.6 CLEAN-UP

- A. During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
- B. Upon completion of painting Work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by the Engineer.

3.7 INSTALLATION OF PIPE AND EQUIPMENT IDENTIFICATION SIGNS, NAMEPLATES AND TAGS

- A. The name of the materials in each pipeline and, alongside this, an arrow indicating the direction of flow of fluids, shall be indicated on each pipe system. Titles shall also appear directly to each side of any wall the pipeline breaches, adjacent to each side of the valve, pump, filter, chemical tank, and all pieces of equipment. Pipe marking labels and arrows shall be located at intervals not to exceed 30 continuous linear feet apart, including any fraction thereof:

1. Material of Construction:

- a. Acrylic plastic with UV inhibitor.
- b. One piece.
- c. Visibility - 360° on pipe sizes less than 6-inch diameter.
- d. Minimum legend Display on pipe circumference - 4.
- e. Mounting/Installation:
 - 1) For pipes less than 6-inch dia. snap-type with no glues, adhesives or straps.
 - 2) For pipes 6-inch dia. and larger - strap-around with nylon ties.
- f. Letter size shall conform to ANSI STD.A13.1.

2. Product and Manufacturer:

- a. Set Mark Pipe Markers as distributed by Seton Name Plate Co., New Haven, Connecticut.
- b. Or equal.

B. Titles shall identify the contents by complete name at least once in each space through which it passes and thereafter by generally recognized abbreviations, letters or numerals as approved by the Engineer. Identification title locations shall be determined by the Contractor but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Titles should be clearly visible from operating positions especially those adjacent to control valves.

C. Signs on large valves shall be located on or adjacent to the valve itself. Tags for smaller valves shall be attached to bonnet or flange bolts. Attachment of tags or signs to handwheels of valves will not be permitted.

D. Nameplates shall be located on equipment bases and on structures at readily visible levels in such positions

relative to the equipment and structures as to prevent damage to the nameplate.

3.8 GUARANTEE

- A. All work under this Section of the Specifications shall be guaranteed against checking, cracking, peeling, discoloration or other defects due to improper materials, or workmanship, due to improper preparation of the surfaces, or due to the painting, varnishing, etc., of surfaces which were not in proper condition to receive paint, varnish or other painter's materials and such unsatisfactory work shall be refinished in accord with the Guarantee requirements of the Contract Documents.

+ + END OF SECTION + +

DIVISION 15 - MECHANICAL

NO TEXT ON THIS PAGE

SECTION 15310

HAND-OPERATED HOISTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work specified Elsewhere:

1. Refer to Division 5 for metal requirements

B. Scope of Work:

1. Furnish and install one hand-generated trolley hoist and appurtenances as shown on Plans and specified herein.

C. Submittals

1. Shop Drawings: Submit for approval the following in accordance with Division 1:
 - a. Copies of manufacturer's technical information for each component of the hoist system
 - b. Operation and maintenance manual

PART 2 - MATERIALS

2.1 FABRICATION AND MANUFACTURE

A. Hoists:

1. All chain shall be Type 304 stainless steel. Hand chain shall come to within 3 feet of the operating floor. Provide a chain container for load chain storage.
2. Furnish hoists with aluminum housing, load limiting device and spur gear reduction gearing.
3. Hoists shall be of the close headroom design, with load brake and enclosed gear train.

4. Trolley Hoists shall be Yale LTP series or equal.

PART 3 - EXECUTION

3.1 SCHEDULE

A. Hoists:

<u>Location</u>	<u>Type</u>	<u>Quantity Req'd</u>	<u>Capacity (lbs)</u>
Tower Room	Trolley	One	2,000

+ + END OF SECTION + +

SECTION 15855

VENTILATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, tools, materials, and equipment necessary for providing ventilation fans and accessories as required for a complete installation.

B. Related Work Specified Elsewhere:

1. Section 15860, Louvers.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. Comply with applicable provisions and recommendations of the following:
 - a. Underwriters Laboratory (UL705)
 - b. AMCA Standard 210
 - c. AMCA Standard 300

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval shop drawings showing the following:

1. Manufacturer's catalog data including materials, design, performance and dimensional information.
2. Manufacturer's published performance curve.
3. List of options and accessories with catalog data.
4. Manufacturer's installation instructions.

B. Test and Certifications:

1. Manufacturer's Certifications.
2. Manufacturer's 1-year warranty.

1.4 MANUFACTURER'S SERVICES

A. Certifications: The manufacturer shall provide the following certifications:

1. Certification that equipment meets the general intent of the specifications and list of all deviation from specifications.
2. Certification that equipment has been installed properly.

B. Manufacturer shall furnish all shop drawings and information as requested by the Engineer.

C. Manufacturer shall provide three copies of instructions for operating, maintaining and lubricating.

D. Manufacturer shall provide a 1-year supply of all necessary lubricants.

E. Manufacturer shall provide a 1-year warranty against defects in parts or workmanship.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: All materials shall be inspected for conformance with approved Shop Drawings.

B. Storage of Materials: All materials shall be stored in the original shipping cartons in a dry location until time of installation.

PART 2 - PRODUCTS

2.1 SIDEWALL PROPELLER EXHAUSTERS

A. Sidewall propeller exhausters shall be axial type and direct drive or belt drive, as listed in the fan schedule.

B. Construction of fan housing shall be galvanized steel with corrosion resistant fasteners.

- C. Propellers shall be constructed of reinforced galvanized steel. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced to ensure minimal noise and vibration.
- D. Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Each motor shall have a factory-wired NEMA 3R power disconnect switch.
- E. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum life in excess of 100,000 hours at maximum cataloged operating speeds. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to wheel and motor shafts. Motor sheaves shall be adjustable for system balancing.
- F. Drive frames shall be formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet Venturi. Drive frames and panels shall be bolted construction or welded construction.
- G. All fans shall bear the AMCA-certified Performance Rating Seal for both air and sound performance.
- H. The following accessories shall be provided with each fan:
 - 1. Short wall housing, flush exterior mount with OSHA guard.
 - 2. 45-degree closure weatherhood.
 - 3. Gravity operated damper and galvanized steel damper guard.
 - 4. Polyester urethane coating on all surfaces of fan wall housing and weather hood.
 - 5. Motor with thermal overloads.
 - 6. Permatector coating (or equal) on inside and outside of fan, and all interior component surfaces.

I. Manufacturer:

1. Sidewall Belt Drive Exhaust Fan:

- a. Greenheck
- b. Or approved equal.

2.2 FAN SCHEDULE

Tag	Type	Location	Greenheck Model No.	Drive	Quantity	Capacity (CFM)	Static Pressure (in-water)	Speed (RPM)	HP	Elec. Char. Hz (Volts/ Phase)
SE-1	Sidewall Propeller Exhauster	Aeration Building, Tower Room	S1-14-440-B6	D	2	1493	0.05	1160	1/6	115V, 1φ
SE-2	Sidewall Propeller Exhauster	Aeration Building, Pump Room	S1-14-440-B6	D	1	1493	0.05	1160	1/6	115V, 1φ

D - Direct Drive
B - Belt Drive

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate wall openings with fan and ventilation equipment dimensions.
- B. Install mounting hardware as recommended by manufacturer.

3.2 INSTALLATION

- A. Install all fans and accessories according to manufacturer's recommendations and published instructions.
- B. Obtain manufacturer's written installation certification.

3.3 COORDINATION

- A. Where existing ventilation fans are shown to be replaced with new equipment, the Contractor shall remove and dispose of the existing ventilator, wall housing, damper and related equipment.
- B. The Contractor shall verify the dimensions of the proposed ventilation equipment and accessories and coordinate opening dimensions to provide an installation which is weather-tight.
- C. It is the Contractor's responsibility to coordinate the ventilation equipment installation with manufacturers and/or subcontractors and to modify openings as necessary and provide additional framing, blocking and caulking as required to seal the equipment completely in the wall opening.

+ + END OF SECTION + +

SECTION 15860

LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, tools, materials, and equipment necessary for providing louvers and accessories as required for a complete installation.

B. Related Work Specified Elsewhere:

1. Section 15855, Ventilation Equipment.

1.2 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Manufacturer's catalog data including materials, design, performance and dimensional data.
2. List of options and accessories furnished with louver along with respective catalog data.
3. Manufacturer's installation instructions.

B. Certifications:

1. Manufacturer's Certifications.
2. Manufacturer's 1-year warranty.

1.3 MANUFACTURER'S SERVICES

A. Certifications: The manufacturer shall provide the following certifications:

1. Certification that the equipment meets the general intent of the specifications and a list of all deviations from specifications.

- 2. Certification that equipment has been installed properly.
- B. Manufacturer shall furnish all shop drawings and information as requested by the Engineer.
- C. Manufacturer shall provide a 1-year warranty against defects in parts and workmanship.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: All materials shall be inspected for conformance with approved Shop Drawings.
- B. Storage of Materials: All materials shall be stored in the original shipping cartons in a dry location until time of installation.

PART 2 - PRODUCTS

2.1 ADJUSTABLE LOUVERS

- A. Adjustable louvers shall be designed to protect air intake in building exterior walls. All adjustable louvers shall be motorized.
- B. The louver frames shall be the channel type fabricated from 16-gauge galvanized steel. Frames shall be 4 inches deep.
- C. The adjustable blades shall be fabricated from 16 gauge galvanized steel.
- D. The linkage shall be concealed inside the frame and shall have 1/2-inch diameter axles with oil impregnated sintered bronze bearings.
- E. All louvers shall be furnished with a bird screen.
- F. The motorized actuators shall be 120 Volts, 2 wire control, internally mounted and shall fail in the closed position (power open, spring closed).
- G. All louvers shall be sized as shown on the drawings and as specified in the louver schedule.
- H. All louvers shall receive a 1.2-mil Kynar finish in a color as selected by the Owner from the manufacturer's color charts.

I. Louvers shall be designed to withstand wind loadings of 16 pounds per square foot or 80 mph.

J. Manufacturer:

1. Greenheck, Model FAJ-402

2. Or equal.

2.2 LOUVER SCHEDULE

<u>Tag</u>	<u>Location</u>	<u>Type</u>	<u>Quantity</u>	<u>Nominal Width/Height (inch/inch)</u>	<u>Free Area (SF)</u>
IL-1	Aeration Building, Tower Room	A	2	24/42	2.50
IL-2	Aeration Building, Blower Room	A	1	24/36	2.17

A = Adjustable with motorized actuator.

M = Manually operated with gear drive and manual actuator.

Note: Process louvers are specified in other sections of these Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all louvers and accessories in accordance with the manufacturer's recommendations and published instructions.

B. Obtain manufacturer's written installation certification.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

DIVISION 16 - ELECTRICAL

NO TEXT ON THIS PAGE

SECTION 16100

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to complete the electrical work as shown and specified. The scope of work includes the following:
1. Electrical demolition of equipment, conduit, wiring, etc.
 2. Furnish and install a new 480 volt electrical service to the Well Building, including replacement of the PSEG padmount transformer and metering, as well as PSEG coordination.
 3. Furnish and install power distribution equipment, such as utility metering, motor control centers, variable frequency drives, panelboards and dry-type transformers.
 4. Furnish and install a 480 volt feeder from the Well Building to the Packed Tower Building.
 5. Furnish and install control and instrumentation interconnections between Well Building and Packed Tower Building.
 6. Furnish and install power, control and instrumentation connections to all mechanical, HVAC and miscellaneous equipment furnished.
 7. Furnish and install indoor, outdoor and emergency lighting systems.
 8. Furnish and install electric unit heaters and thermostats.
 9. Furnish and install a lightning protection system.
 10. Furnish and install security system devices and interconnection wiring.

11. Provide power system studies consisting of short circuit study, coordination study and arc-flash hazard analysis.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the site work, formwork, walls, partitions and ceilings.
2. Coordinate the electrical work with the work by others.

C. General:

1. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment furnished with the space allocated for that equipment.
2. The Drawings show the principal elements of the electrical installation. They are not intended as detailed working drawings for the electrical work but as a complement to the Specifications to clarify the principal features of the electrical systems.
3. It is the intent of this Section that all equipment and devices, furnished and installed under this and other Sections, be properly connected and interconnected electrically with other equipment so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.
4. Mounting heights of switches, receptacles, fixtures and other devices noted in the Specifications and on the Drawings are to the bottom of the device.
5. Refer to Contract Drawings for areas of sheeting and excavation specified under other sections of the Contract. Contractor shall schedule his work on underground conduit runs and hand holes in

these areas to run concurrently with that of the site work.

6. The Contractor shall be responsible for excavation, backfilling, bedding, curbing removal and replacement, concrete cover above conduits, and surface restoration, including pavement for underground conduit and cable installation. Truck vehicle access (H-20 loading) shall be maintained on facility roads during construction.

D. Related Work Specified Elsewhere:

1. Division 1, Special Conditions.
2. Division 2, Sitework.
3. Division 3, Concrete.
4. Division 5, Metals.
5. Division 9, Finishes for field painting.
6. Division 18, Mechanical.

E. Work Included But Specified Elsewhere:

1. All site work required for the construction of the underground structures and pavement restoration shall conform to the requirements of Division 2, Sitework.
2. Concrete work for equipment pads, conduit curbs, and concrete cover for buried conduit shall conform to the requirements of Division 3, Concrete.
3. Anchor bolts and other fasteners shall conform to requirements of Division 5, Metals.
4. Shop painting and surface preparation shall conform to requirements of Division 9, Finishes.

F. Temporary Power: Temporary light and power for construction purposes shall be provided in accordance with Division 1, Special Conditions.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Permits: The Contractor shall, at his own expense, furnish the Owner with a Certificate of Inspection from an approved inspection firm acceptable to the Owner attesting that all electrical work in this Contract has been inspected and is in compliance with the National Electrical Code.
2. Codes: Material and equipment shall be installed in accordance with the current standards and recommendations of the National Electrical Code, the National Electrical Safety Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
3. Tests by Independent Regulatory Agencies: Electrical material and equipment shall be new and shall bear the label of the Underwriters Laboratories, Inc., or other nationally-recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.

B. Reference Standards: Electrical material and equipment shall conform in all respects to the latest approved standards of the following:

1. National Electrical Manufacturers Association (NEMA).
2. The American National Standards Institute (ANSI).
3. The Institute of Electrical and Electronic Engineers (IEEE).
4. Insulated Cable Engineers Association (ICEA).
5. National Electrical Code (NEC).
6. National Electrical Safety Code (NESC).
7. Occupational Safety and Health Code (OSHA).

1.3 SUBMITTALS

- A. General: Conform to requirements of the General Specifications and Special Conditions.
- B. Shop drawings shall include the following information to the extent applicable to the particular item:
 - 1. Manufacturer's name and product designation or catalog number.
 - 2. Electrical ratings.
 - 3. Conformance to applicable standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEC, NEMA, NFPA, OSHA, UL, or other organizations.
 - 4. Dimensioned plan, section, and elevations showing means for mounting, conduit connection, and grounding.
 - 5. Materials and finish specification, including paints.
 - 6. List of components including manufacturer's names and catalog numbers.
 - 7. Internal wiring diagrams indicating all connections to components and numbered terminals for external connections.
 - 8. Manufacturer's instructions and recommendations for installation, operation, and maintenance.
 - 9. Manufacturer's recommended list of spare parts.

1.4 PROJECT CLOSE-OUT

- A. Operation and Maintenance Data: Conform to requirements of the General and Special Conditions.
- B. Provide Certificate of Inspection from an approved inspection firm acceptable to the Owner upon job completion prior to submission of final payment.
- C. Record Drawings: In addition to the requirements of Division 1, Special Conditions, the record drawings shall include the following:

1. One line wiring diagrams of the 480/277-volt and 208/120 volt or 240/120 volt distribution systems.
2. Actual in place conduit and cable layouts with schedule of conduit sizes and number and size of conductors.
3. Layouts of the lighting and other equipment arrangements.
4. Control and noncontrol wiring diagrams with terminal numbers and all devices identified and indicating point-to-point terminations.

1.5 PRODUCT DELIVERY

- A. Delivery of Materials: Contractor shall instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.
- B. Storage: Electrical equipment and material shall be stored and protected in accordance with Division 1 and General and Special Conditions.

1.6 IDENTIFICATION OF EQUIPMENT

- A. All electrical items shall be identified. Identification shall be in addition to the manufacturer's nameplates and shall serve to identify the items function and the equipment or system which it serves or controls.
- B. All new equipment shall be identified by means of laminated phenolic nameplates incised to show 1-inch high, white letters on a black background. Labels shall be fastened by means of 3/16-inch diameter, round-head, stainless steel, self-tapping screws. Equipment whose designation has been changed shall be relabeled accordingly.
- C. Wires and cables shall be color coded and identified by means of wire markers.
- D. Raceways shall be identified by means of vinyl adhesive tape.

- E. Pull and junction boxes shall be identified with laminated phenolic nameplates showing the names of the feeders or system wires and cables passing through them.
- F. The text, size, and type of lettering, and the location of identifying labels or tags, shall be approved by the Owner.

1.7 PROCEDURES FOR INSTALLATION

- A. The Contractor is cautioned to perform his work with due regard to safety and in a manner that will not interfere with the existing equipment or in any way cause interruption of any of the functions of the facility.
- B. Work shall be carried out without disruption to facility operations.
- C. No existing equipment shall be removed, or any live circuits disturbed, without the specific direction and approval of the Owner, and without clearance by appropriate representatives of the Owner. Whenever such work is contemplated, the Contractor shall submit to the Owner a written request for scheduling such work. Written request must be received 5 working days prior to the date on which the proposed work is to be performed.

1.8 MAINTENANCE OF OPERATION

- A. Refer to Specification Section 01010 for Maintenance of Operation requirements.
- B. The Contractor shall be responsible for furnishing temporary generator sets to maintain facility operations for any facility functions, which would be disrupted by any portion of his work.
- C. The Contractor shall furnish written notice to the Engineer and Owner 5 working days prior to performing the work that requires a disruption of power. The written notice shall contain a schedule of proposed work.

1.9 AREA CLASSIFICATIONS

- A. Damp Locations: The following areas shall be considered damp locations:
1. All outdoor locations, unless otherwise specified.
 2. Well Building, Lower Level.
 3. Materials, equipment and incidentals in areas identified as damp locations shall meet NEC and NEMA requirements for wet locations. Enclosures installed in damp locations shall meet NEMA 4X stainless steel requirements as a minimum. Conduits shall be terminated at enclosures with watertight, threaded hubs.
- B. Dry Locations: The following areas shall be considered dry locations:
1. Well Building, First Floor, unless otherwise noted.
 2. Packed Tower Building.
 3. Enclosures installed in these locations shall meet NEMA 12 requirements as a minimum.
- C. Corrosive Locations: The following areas shall be considered corrosive locations:
1. The Lime Room, Chlorine Room and Phosphate Room in the Well Building.
 2. Enclosures installed in these locations shall meet NEMA 4X glass reinforced polyester (fiberglass) requirements as a minimum.

+ + END OF SECTION + +

SECTION 16101

ELECTRICAL SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials and incidentals required to furnish and install a new 480 volt electrical service to the Well Building, including replacement of the PSEG padmount transformer and metering.
2. Contractor shall pay all utility charges for this work.

B. Coordination:

1. Coordinate with PSEG to establish requirements for the service modifications. PSEG Central Division Customer Order Fulfillment (516-545-2242).

C. Related Work Specified Elsewhere:

1. Section 16111, Conduit.
2. Section 16122, 600 Volt Cable.
3. Section 16131, Pull and Junction Boxes.
4. Section 16450, Grounding System.

1.2 QUALITY ASSURANCE

A. Reference Standards

1. National Electrical Code (NEC).
2. National Electrical Manufacturer's Association (NEMA).
3. PSEG - Specifications and Requirements for Electric Installations.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturers technical information, including the following:
 - 1. Site plan locating padmount transformer, metering, related conduit and related wiring.
 - 2. Copies of all utility correspondence.

PART 2 - PRODUCTS

2.1 ELECTRICAL EQUIPMENT

- A. Utility Metering: PSEG approved metering shall be furnished and installed as shown on the Drawings.
- B. Grounding:
 - 1. Contractor shall ground the padmount transformer in accordance with PSEG requirements.
 - 2. Contractor shall ground the electrical service in accordance with NEC and PSEG requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Electrical Service
 - 1. The Contractor shall furnish and install a concrete pad, footing and foundation as per PSEG requirements for the padmount transformer. Furnish and install ground rods for the padmount transformer flush with top of footing per PSEG requirements. The Contractor shall leave a minimum of 5 feet of slack in the primary and secondary cables inside the padmount transformer foundation.
 - 2. The Contractor shall perform all wiring within the transformer pads, including the load break elbow connections to the primary bushings, and hylug

connections to the secondary spade terminals. All required bonding and grounding hardware shall be provided and installed by the Contractor.

3. Primary elbows will be provided by PSEG and delivered with the transformer. The Contractor shall wire each elbow in accordance with PSEG requirements.

3.2 TESTING

- A. Conduit and cable tests shall be in accordance with the specifications.

3.3 IDENTIFICATION

- A. Conduits and cable shall be identified in accordance with Section 16100 of this specification.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16111

CONDUIT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide conduit and fittings as shown and specified to form complete, coordinated and grounded raceway systems.
2. The types of conduit required include the following:
 - a. Rigid galvanized steel for all exposed conduit runs, unless otherwise noted.
 - b. PVC, Schedule 80, for corrosive areas unless otherwise noted.
 - c. PVC, Schedule 40, for exterior underground duct banks as indicated.
3. Unless otherwise shown, all interior conduits shall be run exposed. All conduits, boxes and fittings in finished areas (rooms with suspended ceilings) shall be run concealed.

B. Coordination:

1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping, ductwork, lighting fixtures and other systems and equipment and locate so as to avoid interferences.
2. Prior to installation of conduit, Contractor shall verify equipment locations where conduits are to be terminated and shall verify the size of conduit required for the actual size and number of wires to be installed in the conduits.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting.
2. Section 16116, Expansion Fittings.
3. Section 16118, Flexible Conduits.
4. Section 16131, Pull and Junction Boxes.
5. Section 16134, Outlet Boxes.
6. Section 16402, Underground Duct Banks.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:

1. NEC Article 344, Rigid Metal Conduit: Type RMC.
2. NEC Article 352, Rigid Polyvinyl Chloride Conduit: Type PVC.
3. UL 6, Standard for Electrical Rigid Metal Conduit - Steel.
4. UL 514A, Standard for Metallic Outlet Boxes.
5. UL 514B, Standard for Conduit, Tubing and Cable Fittings.
6. UL 514C, Standard for Nonmetallic Outlet Boxes, Flush-device Boxes, and Covers.
7. UL 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
8. ANSI C80.1, Standard for Electric Rigid Steel Conduit (ERSC).
9. ANSI C80.3, Standard for Steel Electrical Metallic Tubing (EMT).
10. NEMA TC2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

11. NEMA TC3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's catalog cuts and technical information for the conduit, fittings, tooling, installation techniques and supports proposed for use.
2. Construction details of conduit racks and other conduit support systems. Include calculations confirming the adequacy of the proposed systems to support the weight of the conduits and cables being furnished.
3. Layout drawing showing proposed routing of exposed conduits, and concrete encased conduit duct banks directly buried in earth. Drawings shall show rack supports; locations of pull and junction boxes; all penetrations in walls and floor slabs; and equipment where conduit terminates.

B. Record Drawings: Include the actual routing of exposed and below grade conduit runs on record drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rigid Galvanized Steel Conduit, Elbows and Couplings:

1. Material: Rigid, heavy wall, mild steel, hot dip galvanized inside and out, smooth interior, tapered threads and carefully reamed ends; 3/4-inch NPS minimum size.
2. Manufacturers: Provide material manufactured by one of the following:
 - a. Allied Tube and Conduit Corporation.
 - b. Robroy Industries Inc.
 - c. Or approved equal.

B. Plastic Conduit - Schedule 80 PVC:

1. Material: Schedule 80 PVC plastic, NEMA Type TC-2, 90°C rated, conforming to UL 651.
2. Product and Manufacturer: Provide one of the following:
 - a. Carlon Plus 80.
 - b. Certainteed Corporation.
 - c. Scepter Mfg. Co.
 - d. Or approved equal.

C. Plastic Conduit-Schedule 40 PVC:

1. Material: Schedule 40 PVC plastic, NEMA Type TC-2, 90°C rated, conforming to UL 651.
2. Product and Manufacturer: Provide one of the following:
 - a. Carlon Plus 40.
 - b. Certainteed Corporation.
 - c. Scepter Mfg. Co.
 - d. Or approved equal.

D. Conduit Fittings and Outlet Bodies:

1. Material and Construction: For rigid galvanized steel conduit systems, cast gray iron alloy or cast malleable iron bodies and covers; all units to be gasketed and watertight. Gaskets to be of an approved type designed for the purpose. Improvised gaskets not acceptable. All units to be threaded type with five full threads. Material to conform to ANSI C80.4 and be listed by UL. Fittings and bodies in or on PVC conduit runs shall be Schedule 80 PVC. All screws and miscellaneous hardware shall be stainless steel.
2. Manufacturers: Provide material manufactured by one of the following:

- a. Crouse-Hinds Company.
- b. Appleton Electric Company.
- c. Killark.
- d. Robroy Industries, Inc.
- e. Or approved equal.

E. Conduit Hubs:

- 1. Material: Threaded conduit hub, vibration proof, weather proof with captive O-ring seal, zinc metal with insulated throat. Hubs used on PVC conduit systems shall be Schedule 80 PVC.
- 2. Use: Provide for all conduit terminations to boxes, cabinets and other enclosures.
- 3. Manufacturer: Provide material manufactured by Myers Electrical Products Company or approved equal.

F. Supports, Fasteners:

- 1. Individual rigid galvanized steel conduits shall be supported using rigid hot-dip galvanized steel one-hole straps and back straps.
- 2. Multiple rigid galvanized steel conduits shall be supported on rigid hot-dip galvanized steel electrical channel with straps.
- 3. Threaded fasteners shall be stainless steel, including screws, anchors, rods, nuts, spacer washers and miscellaneous items.
- 4. Supports used on PVC conduit systems shall be fiberglass.

G. Conduit Markers: Conduit markers shall be vinyl adhesive tape engraved with the conduit designation and affixed to the conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in conformance with National Electrical Code requirements.
- B. Dissimilar Metals:
 - 1. Take every action to prevent the occurrence of electrolytic action between dissimilar metals.
 - 2. Do not use copper products in connection with aluminum work, and do not use aluminum in locations subject to drainage of copper compounds on the bare aluminum.
- C. Supports:
 - 1. Rigidly support conduits by clamps, hangers, channels or conduit racks.
 - 2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers with hot-dip galvanized steel horizontal members and threaded hanger rods, Kindorf or equal. Rods shall be not less than 3/8-inch diameter and shall be stainless steel.
 - 3. For exposed PVC conduit systems, supports shall be fiberglass, Robroy or approved equal.
- D. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures by the following methods:
 - 1. To Wood: Wood screws.
 - 2. To Hollow Masonry Units: Toggle bolts.
 - 3. To Brick Masonry: Price expansion bolts or equal.
 - 4. To Concrete: Phillips: Hilti Corporation: or approved equal, anchors.
 - 5. To steel: Welded threaded studs, beam clamps or bolts with lock washers or locknuts.

- E. Plug or cap conduit ends at the time of installation to prevent the entrance of moisture and foreign materials.
- F. Empty Conduits:
 - 1. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.
 - 2. Identify each empty conduit with a durable tag showing the conduit number indicated on the Drawings.
- G. Make underground and embedded conduit joints watertight to prevent ground water from entering buildings.
- H. Orientation:
 - 1. Install parallel or perpendicular to structural members or walls, unless concealed.
 - 2. Wherever possible, run in groups.
 - 3. Install on structural members in protected locations.
 - 4. Locate clear of interferences.
 - 5. Locations shown on Drawings are approximate only.
- I. Clearance: Maintain 6 inches from hot fluid lines and 1/4 inch from walls.
- J. End Cuts: Square and ream to prevent damage to wire and cable.
- K. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at any bend.
- L. Threads:
 - 1. Apply conductive compound, Kopr-Shield by T&B Corporation, or approved equal to all joints before assembly.
 - 2. Make up joints tight and ground thoroughly.

3. Conduit and fitting threads to be standard tapered pipe threads. Standard straight thread conduit couplings permitted only on exposed indoor conduit runs. Running threads not permitted.
4. Use strap wrenches and vises to install conduit. Conduit with wrench marks to be replaced.

M. Insulated Bushings:

1. Provide insulated bushings on all conduits entering boxes or cabinets.
2. Provide locknuts on both inside and outside of enclosures except where threaded hubs are provided.
3. Bushings not to be used in lieu of locknuts.

N. Vertical Drops:

1. Rigidly support from equipment or building.
2. Unsecured drop length not to exceed 12 feet.
3. Install vertical runs plumb. No diagonal runs.

O. Thruwall Seals: Install for conduits passing through subsurface walls or floor slabs of buildings.

1. Manufacturer:
 - a. Thunderline "Link Seal".
 - b. O-Z/Gedney.
 - c. Or approved equal.

P. Drainage:

1. Pay particular attention to drainage for conduit runs.
2. Wherever possible, install conduit runs so as to drain to one end and away from buildings.
3. Take extreme care to avoid pockets or depressions in conduit.

Q. Conduit Curb:

1. In concrete slabs or floors, provide a two inch high curb extending two inches from the outer surface of the conduit penetrating the floor, to prevent corrosion.
2. Terminate conduit stub-ups in couplings, slightly above the finished concrete curb.

R. Couplings: Provide full threaded conduit couplings. Split couplings shall not be permitted.

S. For individual exposed conduits passing through floor slabs and walls, install sleeves to protect the conduit against action of alkaline substances which may be present.

T. Before concrete is placed, make the necessary location measurements of the conduit to be embedded so that the information is available to prepare record drawings.

U. Install individual underground conduits 24 inches (minimum) below grade and provide concrete cover above conduits, unless otherwise indicated on the Drawings. The primary service conduits from the utility riser pole to the property line box shall be concrete encased. Perform all excavation, backfilling, bedding, curbing removal and replacement, concrete encasement, and surface restoration including pavement for underground conduit installation.

V. Core drill for individual conduits passing through existing concrete walls or slabs. Obtain authorization from Owner prior to core drilling. Seal spaces around conduit as per 3.1.0 above.

W. Conduit Racks: For rigid galvanized steel conduit systems, provide hot-dip galvanized steel conduit racks of suitable width, length and height and arranged to suit field conditions. For PVC conduit systems, conduit racks shall be fiberglass. Support shall be provided at every ten feet minimum.

X. PVC schedule 80 heavy wall conduit shall be used when entering or exiting new concrete pours, except in hazardous areas where prohibited by code.

- Y. Conduit Expansion and Deflection Fittings: Conduit expansion and/or deflection fittings shall be provided wherever conduit crosses a structural expansion joint, is attached between two separate structures or wherever the conduit run is 100 feet or more in a single straight length.
- Z. Exposed conduits, boxes and fittings shall be painted in accordance with Specification Section 09900.
- AA. Install conduit to maintain fire resistance rating of walls and ceilings. Furnish and install a noncombustible compound that functions as a fire stop sealant for conduit penetrations. Compound shall be GyProc Fire-Halt Sealant or approved equal.

3.2 TESTING

- A. Test conduits by pulling through each conduit a cylindrical mandrel not less than two pipe inside diameters long, having an outside diameter equal to 90 percent of the inside diameter of the conduit.
- B. Maintain a record, by number, of all conduits testing clear.

3.3 IDENTIFICATION

- A. Identify all conduits at the ends and in all intermediate boxes, chambers, hand holes and other enclosures. All conduits shall be identified every 75 feet.
- B. Conduit numbers shall be assigned in accordance with the Conduit and Cable Schedule.

+ + END OF SECTION + +

SECTION 16116

EXPANSION FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide conduit expansion and deflection fittings as shown, specified or required.
- B. Related Work Specified Elsewhere:
 - 1. Section 16111, Conduit.

1.2 QUALITY ASSURANCE

- A. Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. NEC Article 300, Wiring Methods.
 - 2. UL 514B, Standard for Conduit, Tubing and Cable Fittings.
 - 3. UL 467, Standard for Grounding and Bonding Equipment.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for expansion and deflection fittings proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Expansion Fittings: Malleable or ductile iron, hot-dip galvanized, stainless steel clamps and tinned copper braid bonding jumper. Fitting shall be watertight,

corrosion-resistant, UL listed and compatible with the conduit system.

- B. Deflection/Expansion Fittings: Neoprene sleeve, stainless steel bands, and tinned copper braid bonding jumper, suitable for concrete encasement in nonhazardous areas. Fitting shall be watertight, corrosion resistant, UL listed and compatible with the conduit system.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Type DX for expansion/deflection or AX for expansion only by O-Z/Gedney Company.
 - 2. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in conformance with the National Electrical Code where necessary to compensate for thermal expansion and contraction.
- B. Install expansion/deflection fittings where conduits cross structural expansion joints.
- C. Install expansion/deflection fittings in conduit duct banks where conduit is attached between two separate structures.
- D. Install expansion fittings in conduit runs which are 100 feet or more in a single straight length.
- E. Where required in nonmetallic conduit and duct systems, provide necessary coupling to make transition to the threaded metallic fitting.

+ + END OF SECTION + +

SECTION 16118

FLEXIBLE CONDUITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install flexible conduit.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified.
1. NEC Article 350, Liquidtight Flexible Metal Conduit: Type LFMC.
 2. UL 360, Standard for Liquid-Tight Flexible Steel Conduit.
 3. UL 1660, Standard for Liquid-Tight Flexible Nonmetallic Conduit.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's catalog literature, specifications and technical data for flexible conduit and fittings proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Flexible Conduit - Dry and Damp Locations:
1. Material: Flexible galvanized steel core with smooth, abrasion resistant, liquid-tight, neoprene cover. Continuous copper ground built in for sizes

3/4-inch through 1 1/4-inch. Material shall be UL listed.

2. Product and Manufacturer: Provide one of the following:

a. Sealtite UA by Anaconda Metal Hose Division, Anaconda American Brass Company.

b. Liquatite Type L.A. by Electri-Flex Company.

c. Or approved equal.

B. Flexible Conduit Fittings - Dry and Damp Locations:

1. Material and Construction: Malleable iron with zinc electroplate. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.

2. Manufacturers: Provide products of one of the following:

a. Crouse-Hinds Company.

b. Appleton Electric Company.

c. Or approved equal.

C. Flexible Conduit - Corrosive Locations:

1. Material: Flexible nonmetallic conduit, liquid-tight. Material shall be UL listed.

2. Product and Manufacturer: Provide one of the following:

a. Carflex liquid-tight flexible nonmetallic conduit by Carlon.

b. Or approved equal.

D. Flexible Conduit Fittings - Corrosive Locations:

1. Material and Construction: Thermoplastic or PVC liquid-tight nonmetallic. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.
2. Manufacturers: Provide products of one of the following:
 - a. Carflex liquid-tight nonmetallic fittings by Carlon.
 - b. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install at motors and equipment which are subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept 3/4-inch size flexible conduit. Limit flexible conduit length to three feet maximum and install only where required as noted above.
- B. Install in conformance with National Electrical Code requirements.

+ + END OF SECTION + +

SECTION 16122

600 VOLT CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide 600-volt cable as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 16450, Grounding System.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Codes: Cable shall be installed in accordance with the standards and recommendations of the National Electrical Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
 - 2. Tests by Independent Regulatory Agencies: Cable shall bear the label of the Underwriters Laboratories, Inc.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. ASTM B 3, Soft or Annealed Copper Wire.
 - 2. ASTM B 8, Concentric-Lay-Stranded Copper Conductors, Hard, Medium-hard or Soft.
 - 3. ICEA S-95-658/NEMA WC70, Nonshielded Power Cables Rated 2,000 V or Less.
 - 4. National Electrical Code.
 - 5. UL 44, Standard for Thermoset-insulated Wires and Cables.

6. UL 83, Standard for Thermoplastic-insulated Wires and Cables.
7. UL 854, Standard for Service-Entrance Cables.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval manufacturer's literature, specifications, and engineering data for 600 volt insulated cable.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Insulated Cable In Raceways:

1. Material: Single conductor copper cable conforming to ASTM B8 with abrasion resistant, moisture and heat resistant polyvinyl chloride insulated, nylon jacketed rated 90C in dry locations and 90C in wet locations. Cable shall be listed by UL as Type THWN-2. All underground raceways for power wiring shall be wired using extra heavy cross-linked polyethylene wire insulation, rated type USE-2/RHW-2.
2. Where cable is designated as multiconductor on the Drawings (10/c for example), the conductors shall have an overall PVC jacket.
3. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for control.
4. Stranding: All 600 volt cable shall be stranded.
5. Product and Manufacturer: Provide material manufactured by one of the following:
 - a. Okonite Company.
 - b. Superior Essex.
 - c. Or approved equal.

3. Use a dynamometer where mechanical means are used.
 4. Cut off section subject to mechanical damage.
- C. Bending Radius: Limit to 6 times cable overall diameter.
- D. Slack: Provide maximum slack at all terminal points.
- E. Splices:
1. Where possible, install cable continuous, without splice, from termination to termination.
 2. Where required, splice in junction box using terminal boards.
 3. Splices in conduits are not allowed.
 4. Use of screw shell splices, "wire nuts" is not permitted.
- F. Identification: Identify all conductors by circuit number and phase or wire number, at each terminal or splice location. Control conductors shall be numerically coded.
- G. Color code power cables as follows: 208 volt systems - blue, black, and red; 240-volt systems - blue, black and orange; 480 volt systems - brown, orange, and yellow; neutral - white; equipment ground - green; isolated ground - green with yellow stripe.

3.2 TESTING

- A. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
- B. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service with a Megger whose rating is suitable for the tested circuit. Tests shall meet with

the applicable specifications of ICEA S-95-658/NEMA WC70.

- C. The insulation resistance for any given conductor shall not be less than the value recommended by the ICEA or a minimum of 1 megohm for 600-volt and less service, if not ICEA listed. Any cable not meeting the recommended value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16123

INSTRUMENTATION CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide instrumentation cable as shown and specified.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Codes: Cable shall be installed in accordance with the standards and recommendations of the National Electrical Code and with local codes which apply. Where discrepancies arise between codes, the most restrictive regulation shall apply.
 - 2. Tests by Independent Regulatory Agencies: Cable shall bear the label of the Underwriters Laboratories, Inc.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. UL 2250, Standard for Instrumentation Tray Cable.
 - 2. National Electrical Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval manufacturer's literature, specifications, and engineering data for instrumentation cable. This shall be coordinated with requirements of instrumentation equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shielded Cable:

1. Material: Seven strand concentric bare copper wire. Wire shall contain a polyester backed aluminum shield with a tinned copper drain wire. Insulation shall be a 15-mil 90°C flame-retardant PVC jacket, 600-volt minimum. Wire shall be listed by UL as Type TC.
2. Wire Size: No. 16, multiconductor, as required by process equipment. Conductors shall be as shown on Conduit and Cable schedule or drawings.
3. Product and Manufacturer: Provide material manufactured by one of the following:
 - a. Belden.
 - b. Or approved equal.
4. Shielded cable shall be coordinated with requirements of process equipment prior to installation. Shielded cable shall meet all requirements of instrumentation equipment.

B. Cable Connectors, Splices and Terminals, Solderless Type:

1. Use compression type connectors.
2. Product and Manufacturer: Provide one of the following:
 - a. T&B Sta-Kon.
 - b. Burndy Hylug.
 - c. Or approved equal.

C. Cable Markers: Product and Manufacturer: Provide one of the following:

1. Omni-Grip by W.H. Brady Company.

2. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all cables complete with proper terminations at both ends, including all spare cables. Install in conduit separate from power and control cables.
- B. Pulling:
 1. Use insulating types of pulling compounds containing no mineral oil.
 2. Pulling tension shall be within the limits recommended by the wire and cable manufacturer.
 3. Use a dynamometer where mechanical means are used.
 4. Cut off section subject to mechanical damage.
- C. Bending Radius: Limit to 6 times cable overall diameter.
- D. Slack: Provide maximum slack at all terminal points.
- E. Splices:
 1. Where possible, install cable continuous, without splice, from termination to termination.
 2. Where required, splice in junction box using terminal boards.
 3. Splices in conduits are not allowed.
 4. Use of screw shell splices, "wire nuts" is not permitted.
- F. Terminations:
 1. Provide low-voltage barriered, labelable screw-type terminal strips for all instrumentation cables. Label strips to match cable and conductor labeling.

2. Provide separate terminals for all cable shields.
 3. Provide crimp-on, insulated fork terminals for all conductors and shields.
- G. Ground shield at one end only and as recommended by process equipment manufacturer.
- H. Identification: Identify all conductors by circuit number at each terminal or splice location.
- I. Color code cables per ISA and ICEA color coding standards.

3.2 TESTING

- A. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.
- B. Individually test cables for insulation resistance. Test after cables are installed and before they are put in service with a Megger whose rating is suitable for the tested circuit. Tests shall meet with the applicable specifications of the ICEA.
- C. The insulation resistance for any given conductor shall not be less than the value recommended by the ICEA. Any cable not meeting the recommended value or which fails when tested under full load conditions shall be replaced with a new cable for the full length.

+ + END OF SECTION + +

SECTION 16126

FIBER OPTIC CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to install, and place into successful operation, fiber optic cable and appurtenances. The system includes, but is not limited to, fiber optic cables, connectors, patch panels, enclosures and related appurtenances.
2. Fiber optic cable shall be installed, as shown on the Drawings and specified herein.
3. Fiber optic cable shall be coordinated with SCADA system hardware.

1.2 SUBMITTALS

A. Shop Drawings

Submit for approval the following:

1. Manufacturer's product data sheets and complete construction details, including physical characteristics of optical fiber, strength members, and jackets.
2. Overall dimension of cable.
3. Cable pulling plan which specifies the sequence of work tasks, materials, and equipment. The information submitted must include splicing and termination data, including the following:
 - a. List of materials
 - b. Method of connecting cables
 - c. Details of cable preparation

- d. Method of applying materials (including quantities)
 - e. Precautionary measures
 - f. Drawings showing method of splicing, including dimensions
 - g. Written statement from cable manufacturer that splices and terminations submitted are acceptable.
 - h. Written statement from the termination/splice manufacturer that the splices and terminations are suitable for the proposed application.
- 4. Cable manufacturer's certified test data for attenuation and bandwidth and the maximum pulling strain allowed.
 - 5. Provide an optical link analysis for each fiber optic link. Calculate point-to-point (transmit/receive) optical power loss of each fiber link using proposed installed cable lengths. Include all losses through connectors. Submit calculated values, including sketches graphically showing the proposed cable route.
 - 6. Installer and field advisor qualification data, including name, employer, experience with fiber installations, including a list of completed installations, and the names of five references for installations completed that are similar in scope to this project.

1.3 SAMPLES

- A. Provide 2-foot samples of each type of cable.
- B. Sample of each type of splicing and termination material.

1.4 QUALITY ASSURANCE

- A. Installers shall be personally experienced in the installation of optical fiber systems and shall have

been regularly engaged in the installation of fiber cable for a minimum of the past three years.

- B. The installer shall retain the services of a field advisor from the manufacturer for the following:
 - 1. Render advice regarding method of cable installation.
 - 2. Inspection of equipment for installing cable.
 - 3. Witness representative amount of cable pulling.
 - 4. Witness the installation of at least one splice and termination performed by each cable installer.
 - 5. Witness the after installation test.
 - 6. Certify with an affidavit that the aforementioned particulars are satisfactory and the cable is installed in accordance with cable manufacturer's recommendations.
- C. Provide all products in this section from the same supplier.
- D. Provide all cable in accordance with the listing requirements of Article 770 of the National Electrical Code.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Cable Delivery:
 - 1. No cable over 1-year old is acceptable for delivery.
 - 2. Ends of cables are to be kept sealed at all times, except when making splices and terminations. Use methods approved by the cable manufacturer.
 - 3. Include the following data on each reel:
 - a. Facility Name and Address.
 - b. Contractor's Name.

- c. Project Title and Number.
 - d. Date of Manufacture.
 - e. Manufacturer's Name.
 - f. Linear Feet.
 - g. Project specific locations specific cable is to be installed.
- B. Cable Storage: Store cable where the temperature shall be at temperature recommended by the manufacturer for optimum workability.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLE

- A. Provide multimode graded index, buffered, optical glass fiber cores compatible with LED-based transmission systems and suitable for fiber optic Ethernet LAN standards. Cable with plastic fiber core construction shall not be used. The number of cables and the number of fibers in each cable shall be as shown on the drawings. The cable shall be provided with the necessary number of splitter kits to accommodate the number of terminations shown for each interconnection box on the drawings. Cable shall have PVC jacket and shall be suitable for indoor/outdoor use, UL listed type OFNR. Cable shall be UV, water and fungus resistant.
- B. Cable Characteristics:
- 1. Attenuation Loss: less than 3.5 dB/km @ 850 nm
less than 1.5 dB/km @ 1,310 nm
 - 2. Bandwidth: (LED) 200 MHz-km @ 850 nm
500 MHz-km @ 1,310 nm
 - 3. Gigabyte Ethernet Distance: 300 meters @ 850 nm
600 meters @ 1,310 nm
 - 4. Fiber Size: 62.5/125 micron
(core/cladding)

5. Fiber Count: 4
6. Fiber Type: Glass
7. Nominal Cable Diameter: 0.22 inches (for all fiber counts)
8. Nominal Cable Weight: 22 pounds per 1,000 feet
9. Crush Resistance: 1,800 N/cm
10. Maximum Tensile Load (installation): 310 pounds
11. Maximum Tensile Load (in-service): 100 pounds
12. Minimum Bend Radius (installation): 3.4 inches
13. Minimum Bend Radius (in-service): 2.2 inches
14. Operating Temperature: -40 to +85 degrees C

C. Product and Manufacturer:

1. Optical Cable Corporation DX Series
2. Or approved equal

2.2 FIBER OPTIC PATCH PANELS

- A. Fiber optic patch panels shall provide termination and connection points for fiber optic cables. NEMA rating of panel enclosures shall as indicated on the Drawings. Enclosures shall have fiber cable hoops to maintain orderly fiber cable management. Enclosures shall have lockable hasps.
- B. Patch panels shall include fiber optic adapter plates, dual LC type, multimode, ceramic sleeve. Ports shall be provided to match fiber quantity in cable. Ports shall be identified.
- C. Product and Manufacturer:
 1. Optical Cable Corporation

2. Or approved equal

2.3 TERMINAL CONNECTORS

- A. Furnish connectors and components and use specific tools and methods as recommended by the connector manufacturer to form a complete connector system.
- B. Provide fiber optic LC compatible simplex connectors; multimode version. Composite body with a ceramic ferrule.

1. Connector Specifications:

- a. Insertion Loss (typical): .20 dB
- b. Durability Delta (500 rematings): ≤ 0.2 dB
- c. Operating Temperature: -40 to +75 degrees C
- d. Tensile Strength: 15 pounds

2.4 FIBER OPTIC JUMPER CABLES

- A. Provide fiber optic jumper cables, 2 feet in length, 62.5/125 micron multimode fiber compatible with fiber cable specified under paragraph 2.01, complete with LC connectors, and PVC jacket. Provide a quantity equal to the total number of fibers terminated.
- B. Product and Manufacturer:
 - 1. Optical Cable Corporation
 - 2. Or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cable and connectors as indicated on the Drawings and as specified in this section.
- B. Install cables in the indicated raceway systems. Inspect raceways prior to pulling cables. Rod and swab out conduits and ducts prior to installing cables.

- C. Pull cables prior to attachment of connectors. Terminate indicated fibers at each patch panel. Install jumper cables at each patch panel as shown, or as directed by the Engineer.
- D. Pull cables using an indirect attachment method such as a "Kellems Grip," which distributes the pulling forces over the outer portion of the cable. Pulls directly on the fiber core will not be allowed.
- E. Do not exceed maximum pulling strength limits of the cable during installation. Monitor cable pull tensions at all times during the installation of the cable using a remote sensing puller, strain gauge or running line tensiometer. If electronic tension monitoring equipment is used, it shall be calibrated or checked for calibration on a daily basis or prior to any cable pull.
- F. To reduce cable friction and minimize pulling forces during installation, use a polymer based water soluble lubricant when pulling cable.
- G. Do not exceed the minimum bend radius of the cable. Tight loops, kinks, knots or tight bends will not be allowed during installation.
- H. For conduit installation, the minimum bending radius shall be 8 inches. Use sweeping elbows at all transitions from horizontal to vertical conduit runs.
- I. Provide adequate lengths of cable such that all runs, from termination-to-termination are without splices. Cable splices shall be avoided to the greatest extent possible. Where splice are required they shall be done with the approval of the Engineer and in accordance with the manufacturer's recommendations.
- J. Provide pull boxes as required by the cable manufacturer or at a minimum of every 200 feet or at the third 90 degree conduit bend.
- K. Furnish and install patch panels as required.

3.2 IDENTIFICATION

- A. Label each termination point.

- B. Tag each cable in junction boxes and pull boxes. Tags shall indicate the cable number, date installed, type of cable and manufacturer. Attach tags to cable with nonferrous metal wire.

3.3 CHECKOUT AND TESTING

- A. Test fiber optic cables before and after field installation. Tests shall be witnessed by the Engineer.
 - 1. Upon receipt of the fiber optic cable reels, test each fiber separately with an Optical Time Domain Reflectometer (OTDR) to verify fiber length, attenuation and continuity.
 - 2. After the cable has been installed, visually inspect each fiber termination for out-of-round conditions and surface defects such as cracks and micro-chips using a 200x inspection microscope.
 - 3. After connectors have been attached at both ends, test each fiber with an OTDR. Tests shall be bi-directional.
 - 4. Test all fibers, including spares.
- B. Furnish certification documents for each test and record the following data. Include printouts from the OTDR with the certification documents.
 - 1. Installer's company name and address.
 - 2. Installer's name.
 - 3. Date of certification.
 - 4. Attenuation of each fiber link.
 - 5. Length of each fiber optic link measured.
 - 6. Equipment used to certify the fiber optic link.
 - 7. Name of person(s) recording the test data.
- C. Power meters shall have calibrations traceable to National Institute of Standards and Technology (NIST) standards.

- D. The maximum total loss, including connectors and cable attenuation for each fiber optic link shall not exceed 7.5 dB.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16131

PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide pull and junction boxes as shown, specified or required.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
1. NEC Article 314, Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures.
 2. UL 50, Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations.
 3. UL 50E, Standard for Enclosures for Electrical Equipment, Environmental Considerations.
- B. Coordination: Coordinate pull box and junction box installations with piping and other systems and structures. Locate clear of interferences.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for pull and junction boxes proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Junction and Pull Boxes; Small:
1. Material and Construction:

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount boxes so that sufficient access and working space is provided and in accordance with the requirements of the National Electrical Code.
- B. Securely fasten boxes to walls or other structural surfaces on which they are mounted with stainless steel hardware. Provide independent heavy duty, stainless steel supports where no walls or other structural surface exists.
- C. Install pull boxes in runs containing more than three 90 degree bends, runs exceeding 200 feet, where indicated on the Drawings and in conformance with the National Electrical Code.
- D. Size junction and pull boxes in accordance with the requirements of the National Electrical Code.
- E. Provide copper terminal blocks in junction boxes where junction or splices are required in cables. Power terminal blocks shall be rated from 50 to 150 amperes, 600 volt, with one-piece phenolic material and binding screw type, as manufactured by GE type CR2960SY139C series or equal. Wire nuts are not permitted.
- F. Metal barriers shall be installed in all pullboxes containing shielded instrumentation cable and power cable. The barriers shall separate the shielded instrumentation cable from the power cable.

+ + END OF SECTION + +

SECTION 16134

OUTLET BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide outlet boxes for mounting wiring devices and for supporting lighting fixtures as shown, specified and required.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
1. NEC Article 314, Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures.
 2. UL 514A, Standard for Metallic Outlet Boxes.
 3. UL 514B, Standard for Conduit, Tubing and Cable Fittings.
 4. UL 514C, Standard for Nonmetallic Outlet Boxes, Flush-device Boxes, and Covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Device Boxes:

1. Material: Cast gray iron alloy, or cast malleable iron, with zinc electroplate finish in dry and damp locations (weathertight in damp locations), and weather tight PVC in corrosive locations. Boxes shall include external mounting lugs.
2. Device Cover Plates (Receptacles and Miscellaneous Items Only):

- a. Stainless steel Type 304 alloy for dry and damp locations. Weathertight PVC for corrosive locations.
 - b. Weather tight, gasketed spring door cover for devices in damp locations, and corrosive locations. Aluminum in damp locations, PVC in corrosive locations.
 - c. Stainless steel screws and hardware.
3. Manufacturers: Provide material manufactured by one of the following:
- a. Crouse-Hinds Company.
 - b. Appleton Electric Company.
 - c. Carlon Electrical Products.
 - d. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten boxes rigidly and neatly to supporting structures, with stainless steel hardware.
- B. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.
- C. Leave no open conduit holes in boxes. Close unused openings with capped bushings
- D. Label each circuit in boxes and identify with durable tag.
- E. Install in conformance with National Electrical Code.
- F. Lighting fixtures shall not be supported from PVC boxes.

+ + END OF SECTION + +

SECTION 16140

SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide switches for lighting and other systems as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 16134, Outlet Boxes.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified.
 - 1. National Electrical Code.
 - 2. UL 20, Standard for General-use Snap Switches.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for switches proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Dry Locations: Single pole AC toggle switch, quiet type, 120/277 volt AC, 20 ampere, Ivory, specification grade.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Cat. #1221-I, by Harvey Hubbell Incorporated (3-way: Cat. #1223-I).

- b. Cat. #1991-I, by Arrow-Hart Incorporated (3-way: Cat. #1993-I).
 - c. Or approved equal.
- B. Damp Locations: 120 v AC, 20-ampere single pole snap switch, aluminum, weathertight.
 - 1. Product and Manufacturer:
 - a. Series EDS by Crouse Hinds.
 - b. Or approved equal.
- C. Corrosive Locations: NEMA 4X PVC box and cover. Furnish and install AC toggle switch (as specified above) in PVC box with toggle switch cover.
 - 1. Product and Manufacturer:
 - a. PVC box with Model E98TSC cover, by Carlon.
 - b. Or approved equal.
- D. Contactors, where indicated, shall control lighting. Contactors shall be mechanically held, 277 volts, suitable for two-wire control. Specific model numbers shown on Drawings.
 - 1. Product and Manufacturer:
 - a. Square D.
 - b. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices in outlet or device boxes with device cover plates in accordance with Section 16134.
- B. Mount wall switches 4 feet 6 inches above finished floor unless otherwise noted.

C. Install switches in conformance with National Electrical Code.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16141

RECEPTACLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide receptacles as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 16134, Outlet Boxes.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. National Electrical Code.
 - 2. UL 498, Standard for Attachment Plugs and Receptacles.
 - 3. UL 943, Standard for Safety for Ground-fault Circuit Interrupters.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for receptacles proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Dry Locations: Duplex grounding receptacle, two pole, three wire, 125 volt AC, 20 ampere.
 - 1. Product and Manufacturer: Provide one of the following:

- a. Cat. #5362, by Harvey Hubbell Incorporated.
 - b. Cat. #5362, by Arrow-Hart Wiring Devices.
 - c. Or approved equal.
- B. Damp Locations and Corrosive Locations: Duplex grounding receptacle, corrosion resistant, two pole, three wire, 125 volt AC, 20 ampere.
1. Product and Manufacturer: Provide one of the following:
 - a. Cat. #53CM62, by Harvey Hubbell Inc.
 - b. Cat. #5362-CR, by Arrow-Hart Wiring Devices.
 - c. Or approved equal.
- C. Ground Fault Circuit Interrupter Receptacles: Provide GFCI receptacles as shown on the Drawings. GFCI receptacles in unclassified areas shall be duplex grounding, two pole, three wire, 125 volt AC, 20 ampere.
1. Product and Manufacturer:
 - a. Cat. #GF5362, by Harvey Hubbell Inc.
 - b. Cat. #GF5342, by Arrow-Hart Wiring Devices.
 - c. Or approved equal.
- D. Power and Special Receptacles: Provide receptacles with number of poles and voltage and current rating as shown on the Drawings. Coordinate with equipment plugs. Provide matching plug for each receptacle. Coordinate with cables provided with equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices in outlet or device boxes with device cover plates in accordance with Section 16134.
- B. Install receptacles with ground pole in the down position.

- C. Mount receptacles 18 inches above finished floor unless otherwise noted.
- D. Install in conformance with National Electrical Code.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16155

MOTOR STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide individually mounted magnetic and manual motor starters as shown and specified.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable, provisions, and recommendations of the following except where otherwise shown or specified.
1. NEMA Standard ICS2, Industrial Control and Systems: Controllers, Contactors and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC.
 2. UL Electrical Construction Materials Directory (NLDX).
 3. National Electrical Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval, copies of manufacturer's technical information for magnetic motor starters proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Magnetic Motor Starters:
1. Type: Magnetic coil operated, horsepower rated with thermal overload protection.

2. Combination starter with magnetic only motor circuit protector.
3. Enclosures:
 - a. NEMA 12 in dry locations.
 - b. NEMA 4X stainless steel in damp locations.
 - c. NEMA 4X polycarbonate in corrosive locations.
4. Functional Type: Full voltage, single speed, nonreversing unless otherwise noted on Drawings.
5. Start/stop control stations, selector switches, pilot lights and devices as shown on Drawings, and in Schematic Diagrams, for respective starters. Control Devices are specified in Section 16925.
6. Control power transformer with primary and secondary fuses and grounded on low voltage (120 v) side for each starter.
7. Auxiliary contacts for remote status signals and interlocks as shown on the Drawings, and two normally open, and two normally closed, spare contacts.
8. Three-phase, manual reset overload relays and overload heaters sized to coordinate with actual motors being controlled.
9. Engraved phenolic nameplate identifying the equipment controlled; 1/2-inch letters, mounted on wall or suitable support adjacent to starter, if too large to be mounted on the starter itself.
10. Products and Manufacturers: Provide one of the following:
 - a. A200 series by Cutler-Hammer.
 - b. Bulletin 512 by Allen Bradley.
 - c. Class 8539 by Square D Company.
 - d. Or approved equal.

B. Manual Motor Starters:

1. Type: Manual toggle switch, horsepower rated with thermal overload protection.
2. Enclosures:
 - a. NEMA 12 in dry locations.
 - b. NEMA 4X stainless steel in damp locations.
 - c. NEMA 4X polycarbonate in corrosive locations.
3. Manual reset overload relays and overload heaters sized to coordinate with actual motors being controlled.
4. Engraved phenolic nameplate identifying the equipment controlled: 1/2-inch letters, mounted adjacent to starters on wall or suitable support.
5. Products and Manufacturers: Provide one of the following:
 - a. Type B100 by Cutler-Hammer.
 - b. Class 2510 by Square D Company.
 - c. NFS series by Crouse Hinds (NEMA 4X)
 - d. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount equipment so that sufficient access and working space is provided for safe operation and maintenance.
- B. Securely fasten enclosure to wall or other mounting surfaces. Where local wall is not available, provide channel supports (galvanized steel in dry locations, stainless steel in damp and corrosive locations) to rigidly support equipment reasonably close to motor.

Space starter enclosures 1/2 inch from mounting surface.

- C. Install in conformance with the National Electrical Code.

+ + END OF SECTION + +

SECTION 16160

LIGHTING AND DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide lighting and distribution panelboards as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 16920, Motor Control Centers and Variable Frequency Drives.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. NEC Article 408, Switchboards and Panelboards.
 - 2. UL 50, Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - 3. UL 50E, Standard for Enclosures for Electrical Equipment, Environmental Considerations.
 - 4. UL 67, Standard for Panelboards.
 - 5. NEMA PB1, Panelboards.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for panelboards, including circuit breakers, and schedules for particular panelboards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Panelboards:

1. Rating: voltage rating, current rating, number of phases, number of wires and number of poles shall be as indicated on the Schedules.
2. Circuit breakers: Molded case, thermal magnetic type with number of poles and trip ratings as shown on the Drawings. Ground fault circuit interrupter (GFI) breakers shall be furnished as shown on panelboard schedule (UL Class A 4-6 mA for receptacles and UL Class B 30 mA for heat trace cable).
3. Branch circuit interrupting capacity: Refer to panel schedules on Drawings.
4. Bus Bars: 98 percent conductivity copper. All 4-wire panelboards shall have a solid neutral bar. All panels shall have ground bus.
5. Main: Circuit breaker or main lugs only as indicated on the Schedules.
6. Branch circuit breakers connected for sequence phasing.
7. Construction: Ample gutter space, flush door, flush snap latch and lock. Panelboards shall be rated NEMA 12 in dry locations and NEMA 4X (stainless steel) in damp locations.
8. Trim: Surface as required to meet requirement of mounting.
9. Directory: Typed card with glass cover in frame on back of door giving the circuit numbers and the area or equipment served.
10. Identification: Nameplate identifying the panel number and voltage.
11. Product and Manufacturer: Provide one of the following:

- a. 120/208 Volt and 120/240 Volt Panels:
 - 1) "Pow-R-Line 1" by Cutler Hammer.
 - 2) Or approved equal.
- b. 480 Volt Panel:
 - 1) "Pow-R-Line 3a" by Cutler Hammer.
 - 2) Or approved equal.

12. Schedules: The panelboard schedules are on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting: Panelboards shall be flush mounted in the motor control center or surface mounted, and provided with hinged cover door with latch, lock, and 4 keys.
- B. Directory: Complete typewritten directory indicating items controlled by each circuit breaker and the size of feeder serving the panel. The location and identification of feeder overcurrent device serving the panel shall be mounted on the panelboard.
- C. Balance the loads on the panelboards.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16170

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide disconnect switches as shown and specified and as required by the National Electrical Code.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
1. National Electrical Code.
 2. UL 98, Standard for Enclosed and Dead-front Switches.
 3. NEMA KS1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for disconnect switches proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Disconnect Switches (Single Throw):
1. Type: Unfused, service entrance equipment rated where applicable; horsepower rated, heavy-duty, single throw, two pole and three pole with visible blade and safety handle, lockable in the open position.

2. Enclosure: NEMA 12 for dry locations, NEMA 4X stainless steel for damp locations and NEMA 4X fiberglass for corrosive areas.
 3. Provide nameplate identifying equipment being disconnected.
 4. Product and Manufacturer: Provide material manufactured by one of the following:
 - a. Crouse-Hinds Company.
 - b. Appleton Electric Company.
 - c. Square D.
 - d. Or approved equal.
- B. Disconnect switch voltage ratings shall be suitable for equipment served.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount equipment so that sufficient access and working space is provided for ready and safe operation and maintenance. Mount all disconnect switches four feet above floor level.
- B. Securely fasten equipment to walls or other structural surfaces on which they are mounted. Provide independent supports (galvanized steel in dry locations, stainless steel in damp and corrosive locations) where no wall or other structural surface exists.
- C. Furnish and install disconnect switches where shown on the drawings.
- D. Furnish and install disconnect switches, as a minimum, in all locations required by the National Electrical Code.

+ + END OF SECTION + +

SECTION 16292

POWER DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Power system studies shall be provided in accordance with the requirements specified under this section.
- B. The power system studies shall consist of a short circuit analysis, protective device coordination analysis, arc-flash hazard analysis and harmonics study. The studies shall include the PSEG padmount transformer, main incoming switchgear, 480 volt motor control centers (existing and new), and 208/120 volt panelboards (existing and new).

1.2 REFERENCES

- A. The power distribution system coordination shall comply with the latest applicable provisions and recommendations of the following:
 - 1. NFPA 70 - National Electrical Code
 - 2. ANSI Standard C37.04 - Rating Structure for AC High Voltage Circuits Rated on a Symmetrical Basis
 - 3. ANSI Standard C37.010 - Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Basis
 - 4. IEEE 141 - Recommended Practice for Electric Power Distribution in Industrial Plants
 - 5. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis

1.3 SUBMITTALS

- A. Contractor shall submit the short circuit and protective device coordination studies for approval as follows:
1. Calculations and results of the power system studies shall be submitted. The short circuit study, protective device evaluation and coordination studies shall be submitted in a report format. The report shall be stamped and signed by a Licensed Professional Engineer.
 2. Qualifications of proposed firm to provide the power system studies.

1.4 QUALITY ASSURANCE

A. General:

1. The power system studies shall be performed in accordance with the latest applicable provisions and recommendations of the following:
 - a. NFPA 70, National Electrical Code
 - b. ANSI C37.04
 - c. ANSI C37.010
 - d. IEEE 141
 - e. IEEE 399
2. The Contractor shall retain the services of a Professional Engineer, licensed in the State of New York, to perform the power system studies.
3. The Contractor shall coordinate with the Engineer performing the studies and assist him in the collection of all information necessary to complete the studies specified.
4. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology and the NETA maintenance testing specification.

PART 2 - PRODUCTS

2.1 POWER SYSTEM STUDIES

A. General:

1. The Contractor shall provide a current and complete short-circuit study, protective device coordination study and arc flash hazard analysis for the electrical distribution system.
2. The studies shall include all portions of the electrical distribution system from the PSEG transformer, main incoming switchgear, motor control centers (existing and new) and panelboards (existing and new).
3. Problem areas or equipment inadequacies shall be promptly brought to the Engineer's attention.

B. Short Circuit Study:

1. The short circuit study shall be performed with the aid of a computer program.
2. The study input data shall include the utility company's short circuit, single and three phase contributions, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
3. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
4. The short circuit tabulations shall include symmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, including motor back EMF

current contributions shall be listed with its respective X/R ratio.

C. Protective Device Coordination Study:

1. A protective device coordination study shall be performed to select or to check the selections of the power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and setting.
2. The overcurrent device settings computed in the coordination study shall provide complete 100 percent selectivity. The system shall be selectively coordinated such that only the device nearest a fault will operate to remove the faulted circuit. System selectivity shall be based on both the magnitude and the duration of a fault current.
3. The coordination study shall include all voltage classes of equipment starting at the utility's incoming line protective device down to and including each of the medium and low voltage equipment. The phase and ground overcurrent and ground fault protection shall be included, as well as settings for all other adjustable protective devices.
4. The time-current characteristics of the installed protective devices shall be plotted on the appropriate log-log paper. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate selective coordination achieved to the utility main breaker, power distribution feeder breakers, and the overcurrent devices at each major load center.
5. There shall be a maximum of eight protective devices per plot. Each plot shall be appropriately titled. Plots shall include the

following information as required for the circuits shown:

- a. Representative one-line diagram, legends and types of protective devices selected.
 - b. Power company's relays or fuse characteristics.
 - c. Significant motor starting characteristics.
 - d. Parameters of transformers, ANSI magnetizing inrush and withstand curves.
 - e. Operating bands of low voltage circuit breaker trip curves, and fuse curves.
 - f. Relay taps, time dial and instantaneous trip settings.
 - g. Cable damage curves.
 - h. Symmetrical and asymmetrical fault currents.
6. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.

D. Arc-Flash Hazard Analysis

1. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
2. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
3. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances,

personal-protective equipment classes and AFIE levels.

4. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.
6. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the *IEEE Guide for Performing Arc-Flash Calculations*.
7. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.

2.2 STUDY REPORT

- A. The results of the power system study shall be summarized in a final typewritten report. The report shall include the following Sections:
 1. Description, purpose, basis, written scope, and a single-line diagram of the power distribution system which is included within the scope of the study.
 2. Tabulations of circuit breaker, fuses, and other equipment ratings versus calculated short-circuit duties, and commentary regarding same.
 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 4. Fault current tabulation including a definition of terms and a guide for interpretation.
 5. Tabulation of appropriate tap settings for relay seal-in units.

PART 3 - EXECUTION

3.1 FIELD TESTING

- A. Coordinate findings of the short circuit study and protective device coordination study with the electrical distribution equipment.

END OF SECTION

NO TEXT ON THIS PAGE

SECTION 16321

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide dry type transformers as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Division 3, Concrete.
 - 2. Section 16920, Motor Control Centers and Variable Frequency Drives.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. ANSI C57.12, General Requirements for Dry-Type Distribution and Power Transformers.
 - 2. UL 506, Standard for Specialty Transformers.
 - 3. UL 1561, Standard for Dry-Type General Purpose and Power Transformers.
 - 4. National Electrical Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for transformers proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dry Locations:

1. Type: General purpose, dry type, 60 Hz.
2. Rating: kva, primary voltage and connection, secondary voltage and connection, and number of phases shall be as indicated on the Drawings.
3. Taps: Full capacity, two 2-1/2 percent primary taps above normal and two 2-1/2 percent primary taps below normal.
4. Sound Level: ANSI C89.2 standard.
5. Enclosure: Open type for mounting in motor control centers; totally enclosed non-ventilated for separately mounted transformers.
6. Insulation: Class 185°C, 115°C rise.
7. Identification: Diagrammatic nameplate identifying the transformer number and voltage.
8. Product and Manufacturer: Provide equipment manufactured by the following:
 - a. Cutler-Hammer type EP.
 - b. Or approved equal.

B. Damp Locations:

1. Type: General purpose, dry type, high efficiency, 60 Hz, with weathershield.
2. Rating: kva, primary voltage and connection, secondary voltage and connection, and number of phases shall be as indicated on the Drawings.
3. Taps: Full capacity, two 2 1/2 percent primary taps above normal and four 2 1/2 percent primary taps below normal.
4. Sound Level: ANSI C89.2 standard.

5. Insulation: Class 220°C, 80°C rise.
6. Identification: Diagrammatic nameplate identifying the transformer number and voltage.
7. Product and Manufacturer: Provide equipment manufactured by the following:
 - a. Cutler-Hammer.
 - b. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Transformers shall be furnished and installed as an integral part of the motor control center where specified.
- B. Mount transformers so that vibrations are not transmitted to the structural parts of the building.
- C. Adjust tap settings to provide proper voltage at panelboards.
- D. Ground transformers in conformance with the National Electrical Code.
- E. Conduit connections within two feet of transformer shall be made with flexible conduit.
- F. Floor mounted transformers shall be installed on vibration isolators and concrete pads designed to minimize noise transmission.
- G. Provide top jumper cables.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 16402

UNDERGROUND DUCT BANKS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide underground duct banks as shown and specified.
- B. Coordination:
 - 1. Duct bank routing on the Drawings is diagrammatic. Coordinate installation with piping, sheet piling and other underground systems and structures and locate clear of interferences.
 - 2. Refer to plans for areas of sheeting and excavation and the Contractor's sequence of construction. Contractor shall schedule his work on duct banks in these areas to run concurrently with that of other trades.
 - 3. The Contractor shall be responsible for excavation, backfilling, curbing removal and replacement, and surface restoration to match existing conditions. Truck vehicle access (H-20 loading) shall be maintained during construction.
- C. Related Work Specified Elsewhere:
 - 1. Division 1, General Requirements.
 - 2. Site work shall conform to the requirements of Division 2, Site Work.
 - 3. Concrete work shall conform to the requirements of Division 3, Concrete.
 - 4. Section 16111, Conduit.
 - 5. Section 16404, Manholes and Handholes.

NO TEXT ON THIS PAGE

SECTION 16426

MAIN INCOMING SWITCHGEAR

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals required to furnish and install the main incoming switchgear, service entrance rated, as shown and specified.
2. A single line diagram is shown on the Drawings.
3. Switchgear details are shown on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 18500, SCADA System Work

1.2 QUALITY ASSURANCE

A. Reference Standards

1. ANSI 61.
2. ANSI/NEMA PB 2, Deadfront Distribution Switchboards.
3. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Range 600 Volts or Less.
4. ANSI/NFPA 70, National Electrical Code.
5. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches.
6. NEA KS 1, Fused and Non-fused Switches.
7. UL 489, Molded Case Circuit Breakers.
8. UL 891, Deadfront Switchboards.

9. UL 98, Enclosed and Deadfront Switches.
10. UL 977, Fused Power Circuit Devices.
11. UL 1066, Low Voltage Power Circuit Breakers.
12. PSEG

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval three copies of manufacturer's technical information, including the following:
 1. Enclosure detail, including dimensions.
 2. Single-line diagram.
 3. Layout of compartments, including CT cabinet and breaker locations.
 4. Catalog cuts of all components (circuit breakers, surge arrestor, etc.).
 5. Installation instructions.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.
- B. Standard Features
 1. Switchboards shall be fully self-supporting structures with 90 inch tall vertical sections (excluding lifting eyes and pull boxes) bolted together to form required arrangement.
 2. Switchboard frame shall be die formed, 12 gauge steel with reinforced corner gussets. Frame shall be rigidly bolted to support cover plates (code

gauge steel), bus bars and installed devices during shipment and installation.

3. All sections may be rolled, moved or lifted into position. Switchboards shall be capable of being bolted directly to the floor without the use of floor sills.
4. All switchboard sections shall have open bottoms and removable top plate(s) to install conduit.
5. Switchboard sections shall be front and rear aligned.
6. Switchboards shall be UL listed.
7. Switchboards that are series rated to short circuit requirements shall be appropriately labeled. Tested UL listed combination ratings shall be included in UL recognized Component Directory.
8. All covers shall be fastened by hex head bolts.
9. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex head bolts.
10. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation and control wiring. Switchboards and devices shall be rated for the voltage and frequency listed on the drawings.
11. Switchboard current ratings, including all devices, shall be based on a maximum ambient temperature of 40 degree C per UL Standard 891. With no derating required, temperature rise of switchboards and devices shall not exceed 65 degrees C in a 40 degree C ambient environment.
12. Switchboard Service Entrance sections shall comply with UL Service Entrance requirements including a UL service entrance label, incoming line isolation barriers, and a removable neutral

bond to switchboard ground for solidly grounded wye systems.

13. The group mounted feeder breaker and/or main devices within switchboards shall be circuit breakers or fusible switches as indicated on the drawings. Mounting for the group mounted circuit breakers shall be by bolted connections.

C. Incoming Section

1. Incoming section shall be utility CT section and main breaker.
2. Furnish switchboard arranged for top entry of incoming cable.
3. Provide crimp compression type lugs in the quantity and size required per the contract drawings. All lugs shall be tin-plated aluminum and UL listed for use with copper cable. Lugs shall be rated for 75 degree C. cable.

D. Bus Bars

1. Bus bars shall be tin-plated copper. The bus bars shall have sufficient cross sectional area to meet UL 891 temperature rise requirements. Phase and neutral bus ampacity shall be as shown on the plans. The neutral bus shall have the same ampacity as the phase bus.
2. Bus bars shall be mounted on high impact, non-tracking insulated supports. Joints in the vertical bus are not permitted.
3. Bus bars shall be braced to withstand mechanical forces exerted during short circuit conditions as indicated in drawings, but in no case less than 65kA RMS SYM.
4. Bus joints shall be bolted with high tensile steel Grade 5 bolts. Belleville type washers shall be provided with aluminum bus.
5. Ground Bus shall be sized to meet UL 891. Ground bus shall extend full length of switchboard. Ground bus shall be copper

6. A-B-C bus arrangement (left to right, top to bottom, front to rear) shall be used throughout to assure convenient and safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.
7. All feeder device line and load connection straps shall be rated to carry current rating of device frame (not trip rating).
8. The main incoming bus bars shall be rated for the main protection device frame size or main incoming conductors, if there is no main device.
9. Main horizontal bus bars shall be fully rated and arranged for future extensions.

E. Enclosure

1. Switchboard(s) shall be indoor type, NEMA 1 drip-proof deadfront construction, front accessible only.

F. Utility Metering Section

1. Provide utility metering section where indicated on drawings. Pull section and metering compartment shall comply with PSEG requirements.
2. Compartment shall be barriered from the rest of the section, have a hinged lockable front cover, removable bus links with provisions for mounting current transformers, and when required, provisions for mounting voltage transformers. Current and voltage transformers shall be supplied and installed by the utility company.

G. Main Breaker

1. Main breaker shall be individually mounted, insulated case circuit breaker. Provide device as specified in appropriate article below.
2. Provide the following with the main breaker:
 - a. auxiliary contacts

H. Feeder Breakers

1. Feeder breakers larger than 1200 amps shall be individually mounted insulated case circuit breakers.
2. All circuit protective devices shall have the following minimum symmetrical current interrupting capacity.
3. Provide the following with the feeder device(s):
 - a. auxiliary contacts

I. Insulated Case Circuit Breakers

1. Insulated case circuit breakers shall be individually mounted.
2. Main breaker shall be manually operated, stationary mounted. Feeder breakers shall be manually operated, stationary mounted.
3. Breakers shall be constructed of a high dielectric strength, glass reinforced insulating case. The interrupting mechanism shall be arc chutes. Steel vent grids shall be used to suppress arcs and cool vented gases. Interphase barriers shall to isolate completely each pole.
4. Breakers shall contain a true two-step stored energy operating mechanism which shall provide quick make, quick break operation with a maximum five cycle closing time. Breakers shall be trip free at all times. Common tripping of all poles shall be standard.
5. Insulated case circuit breakers shall be rated to carry 100 percent of their frame ampacity continuously.
6. A charging handle, close push-button, open push-button, and Off/On/Charge indicator shall be located on the breaker escutcheon and shall be visible with the breaker compartment door closed.
7. Where drawout breakers are specified, the drawout design shall permit the breaker to be withdrawn

from an engaged position, to a test position, and to a disengaged position.

J. Molded Case Circuit Breakers

1. Group mounted breakers shall be connected to the vertical bus by bolted connections.
2. Individually mounted molded case circuit breakers shall be stationary mounted.
3. Circuit breaker frames shall be constructed of a high-strength, molded, glass-reinforced polyester case and cover. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation. The design shall provide common tripping of all poles. Breakers shall be suitable for reverse feeding.
4. Breakers shall have ON and OFF position clearly marked on escutcheon. Breakers shall include a trip-to-test means on the escutcheon for manually tripping the breaker and exercising the mechanism and trip latch.
5. Breakers shall include factory installed mechanical lugs. Lugs shall be UL listed and rated 75 or 60/75 degrees C as appropriate. Breakers shall be standard, or 80 percent rated.
6. Breakers larger than 150 amps shall use digital true RMS sensing trip units and a rating plug to determine the breaker trip rating.

K. Digital Electronic Trip Unit for Main and Feeder Circuit Breakers

1. Each main and feeder circuit breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, and short circuits and ground faults. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.

Furnish digital electronic trip units as specified below.

2. As a minimum, the trip unit shall have the following protective functions unless otherwise indicated on the drawings:
 - a. adjustable current setting or long time pickup;
 - b. adjustable long time delay (22 bands);
 - c. switchable, adjustable short time pickup and delay (11 bands) with 3 I²t selectable slopes;
 - d. adjustable instantaneous pickup;
 - e. adjustable ground fault pickup and delay.
 - f. Zone Selective Interlocking for Short Time, Ground Fault and Instantaneous protection.
3. As a minimum, the trip unit shall include the following features:
 - a. Long time and short time protective functions, if provided, shall have true RMS sensing technology and thermal long time memory.
 - b. Ground fault protective function, if provided, shall contain a memory circuit to integrate low level arcing fault currents with time, to sum the intermittent ground fault spikes.
 - c. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.
 - d. Multi-button keypad to provide local setup and readout of all trip settings on the LCD.
 - e. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.

- f. An integral test jack for testing via a portable test set and connection to a battery source.
 - g. A mechanism for sealing the rating plug and the trip unit.
 - h. Noise immunity shall meet the requirements of IEEE C37.90.2.
 - i. Display trip targets for long time, short time, and ground fault, if included.
 - j. The trip unit shall keep a log of the last ten events including overcurrent trips, protective relay trips. The log shall store rms currents, phase, type of trip, trip counter, time and date for each event.
 - k. Instantaneous trip shall utilize filtering which permits fully selective operation with downstream current limiting devices up to the short time rating of the circuit breaker, when the instantaneous pickup is set above the current limiting threshold.
4. The trip unit shall include the following metering functions, which shall be displayed on the LCD (if the manufacturers trip unit can not incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker):
- a. Current, RMS, each phase;
 - b. Voltage, RMS (V), line-to-line or line-to-neutral.
 - c. Energy (kWh, MWH, GWH), each phase and total, user resettable.
 - d. Peak Power Demand (KW, MW), user resettable.
 - e. Real power (KW, MW), each phase and total.
 - f. Reactive power (KVAR, MVAR), each phase and total.

- g. Apparent power (KVA, MVA) , each phase and total
 - h. Frequency (Hz).
 - i. Power factor.
5. The trip unit shall include all of the following protective functions. It shall be possible to disable, by user programming, any combination of unwanted protective functions. Except for reverse power, relay settings shall be in 1 percent steps over indicated range. Each function shall have a time delay, adjustable in 1-second increments (1 to 15 seconds) and shall be able to be switched OFF. If the manufacturers trip unit can not incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker.
- a. Undervoltage, adj. pickup, 50 to 90 percent; 1% increment adj. delay, 1 to 15 seconds.
 - b. Overvoltage, adj. pickup, 110 to 150 percent; 1% increment adj. delay, 1 to 15 seconds.
 - c. Voltage unbalance, adj. pickup, 10 to 50 percent; adj. delay, 1 to 15 seconds.
 - d. Current unbalance, adj. pickup, 10 to 50 percent; 1% increment adj. delay, 1 to 15 seconds.
 - e. Reverse power, selectable direction, adj. pickup, 10 KW to 990 KW; 10kW increment adj. delay, 1 to 15 seconds.

L. Metering Transformers

- 1. All instrument transformers shall be UL listed and classified as indicated in drawings.
- 2. Current Transformers shall be as shown on drawings with burden and accuracy to support connected meters and relays as required by ANSI/IEEE C57.13.

3. Potential transformers shall be provided where indicated on drawings with burden and accuracy to support connected meters and relays as required by ANSI/IEEE C57.13.

M. Bus Metering (Microprocessor Based):

1. The new motor control center in the Booster Building shall contain microprocessor based three-phase metering to monitor and display phase currents, voltage (line-line, line-neutral), real power and reactive apparent power, power factor, frequency, energy (watt hours, VAR- hours, and VA-hours) and total harmonic distortion readings for voltage and current.
2. The metering device shall have one normally open and one normally closed contact for power failure condition.
3. Ethernet output for transmission of phase to phase voltages and amperage on each phase to SCADA.

2.2 FINISH

- A. All steel surfaces shall be chemically cleaned prior to painting.
- B. Exterior paint color shall be ANSI 61 Light Gray over phosphate - type rust inhibitor.

2.3 ACCESSORIES

- A. Fuses
 1. Manufacturer: Ferraz Shawmut (or equal).
 2. Interrupting Rating of all fuses shall be 200,000 RMS amperes.
- B. Furnish nameplates for each device as indicated in drawings.
- C. Provide a lightning surge arrestor, served from the load side of the main breaker with circuit breaker sized as per the manufacturer's recommendations shall be provided. Surge arrestor shall be rated for a surge current of 200KA and shall have LED protection status indicators. Surge arrestor shall be Model

200LS as manufactured by MCG Surge Protection, or approved equal.

2.4 SPARE PARTS

A. Four fuses of each size and type.

2.5 Factory testing shall be provided on the unit. The switchboard shall be completely assembled, wired, adjusted and tested at the factory. The main circuits shall be given a dielectric test of 2200 volts for one minute between live parts and ground, and between opposite polarities. A certified test report shall be submitted to the Engineer.

2.6 Product and Manufacturer: Provide electrical service switchboard manufactured by one of the following:

- A. General Electric
- B. Siemens
- C. Or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide no openings in top or side of units.
- B. Set circuit breaker trip units to coordinate with upstream and downstream protective devices.
- C. Field test all switchboard components.
- D. Install in conformance with the National Electrical Code.
- E. Store the switchboard in a certified heated warehouse.
- F. Install on concrete foundation.

3.2 START-UP AND COMMISSIONING

- A. The Contractor shall furnish the services of the manufacturer's representative for start-up and commissioning of the switchgear. This shall include properly setting of the trip units for the circuit

breakers as recommended by the coordination study and approved by the Engineer.

+ + END OF SECTION + +

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SECTION 16450

GROUNDING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide a complete new grounding system for the new facilities and equipment as shown, specified and required by the National Electrical Code.
- B. Related Work Specified Elsewhere:
 - 1. Division 2, Site Work.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. NEC Article 250, Grounding and Bonding.
 - 2. UL 467, Standard for Grounding and Bonding Equipment.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for grounding materials proposed for use.
- B. Test Data: Submit for approval results of ground resistance testing.

- 1) Cadweld by Erico Products, Incorporated.
- 2) Therm-O-Weld by Burndy Corporation.
- 3) Or approved equal.

PART 3 - EXECUTION

3.1 FACILITY GROUND SYSTEM

- A. Install ground rods in locations shown on the drawings to provide a resistance to ground of less than 5 ohms.
- B. Weld all buried connections. Buried bolted connections are not permitted.
- C. Provide accessible test points for measuring the ground resistance of ground grids.
- D. Coordinate all work with site work by other trades.
- E. Ground new electrical services in accordance with NEC requirements.

3.2 EQUIPMENT GROUNDING

- A. Ground all electrical equipment in compliance with the National Electrical Code.
- B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in metal conduit where necessary for mechanical protection.
- C. Connect ground conductors to conduit with copper clamps, straps or with grounding bushings.
- D. Connect to piping by welding or brazing. Use copper bonding jumpers on all gasketed joints.
- E. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations designated by the Engineer.

- F. Connect to motors by bolting directly to motor frames, not to sole plates or supporting structures.
- G. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on all gasketed joints.
- H. Scrape bolted surfaces clean and coat with a conductive oxide resistant compound.

3.3 TESTING

- A. Test the complete ground systems for continuity and for resistance to ground of less than five ohms using an electrical ground resistance tester. Furnish certified report to Engineer.

+ + END OF SECTION + +

SECTION 16510

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide lighting fixtures as shown and specified.
- B. Coordination: Coordinate location of fixtures with piping, ductwork, openings and other systems and equipment and locate clear of interferences.
- C. Related Work Specified Elsewhere:
 - 1. Section 16111, Conduit.
 - 2. Section 16134, Outlet Boxes.
 - 3. Section 16140, Snap Switches.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. National Electrical Code.
 - 2. UL 1598, Standard for Luminaires.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for lighting fixtures, including ballasts.

1.4 SPARE PARTS

- A. Fluorescent Lamps: 12 of each type specified.
- B. Metal Halide and High Pressure Sodium Lamps: Two of each size required.

- C. Incandescent, Quartz and Sealed Beam Lamps: Two of each size required.
- D. LED Fixtures: One of each fixture type required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type: Fixtures to be complete with supports, ballasts, lamps and incidentals as required.
- B. Lamps:
 - 1. Fluorescent: Cool white, energy efficient type, screw in, 32 Watt, T-8, 48", Rapid-Start (GE or equal).
 - 2. Metal Halide: G.E. "Multi-Vapor," or equal.
 - 3. High Pressure Sodium: G.E. "Lucalox," or equal.
- C. Ballasts:
 - 1. Fluorescent: Electronic energy efficient type. THD shall be less than 10%.
 - 2. High Intensity Discharge: High power factor, constant wattage, stabilized autotransformer with line starting current the same or less than operating current.
 - 3. Ballasts to have "C" sound rating (min.) and be ETL/CBM certified.
 - 4. Ballasts shall be manufactured by General Electric, Magnetek, Advance or equal.
- D. Hardware: All necessary hangers, supports, conduit adaptors, reducers, hooks, brackets and other hardware required for safe fixture mounting shall be furnished. Hardware shall be stainless steel.
- E. Schedule: The lighting fixtures shall be provided in accordance with the following schedule:

<u>Type</u>	<u>General Description</u>	<u>Lamps</u>	<u>Mfgr. & Cat. No.</u>
A	High output LED canopy fixture, cast aluminum, weather-tight, petroleum symmetric distribution, corrosion resistant, 350mA driver, 120/277V.	60 LED	Beta LED model CAN-EDG-PS-PM-06-E-UL-WH-350-40K-26AS, or approved equal.
B	Wall mounted LED fixture, die cast aluminum, weatherproof, stainless steel hardware, forward throw, 350mA driver, 120V, photocell.	48 High brightness LEDs	LSI Industries XPWS3-FT-LED-48-350-NW-UE-BLK-PCI120-26AS, or approved equal.
C	Wall mounted LED fixture, weathertight, type II medium distribution, corrosion resistant, 350mA driver, 120/277V.	120 LED	Beta LED model SEC-EDG-2M-WM-UL-WH-350-40k, or approved equal.
D	Wall mounted LED fixture, weathertight, type II medium distribution, corrosion resistant, 350mA driver, 120/277V.	120 LED	Beta LED model SEC-EDG-2M-WM-UL-WH-350-40k, or approved equal.
EM	Emergency light unit with battery pack, NEMA 12 enclosure, 120V.	(2) 8 Watt	Big Beam 2SE6S8, or approved equal.
EX	Wall mounted LED exit sign, emergency battery pack, damp location, 120V.	LED	Big Beam EXKL-2-R-W-W-U, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.

- B. Suspended Fixtures: Pendant mount using 1/2-inch conduit stems. Ground to outlet box. Attach mounting to building structure with expansion anchors.
- C. Surface Mounted Fixtures: Attach to appropriate outlet box.
- D. Boxes and Fixtures:
 - 1. For units mounted against masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.
 - 2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers or Unistrut.
 - 3. No boxes shall be installed with open conduit holes.
 - 4. Cable each circuit and identify with tag.
- E. Mounting Heights: Mounting heights or elevations are to bottom of the fixture or to centerline of device.
- F. Install fixtures in conformance with the National Electrical Code.
- G. Relamp all fluorescent fixtures with new lamps at end of construction period, prior to final acceptance of the facilities by the Owner.

+ + END OF SECTION + +

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 Description

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide an Underwriters' Laboratories listed master labeled lightning protection system for the new and existing facilities.
2. The materials in this specification section are copper. If aluminum is required due to the construction of the packed tower, roof, etc., the equivalent aluminum conductors, air terminals, connectors, etc. shall be furnished and installed.

B. Related Work Specified Elsewhere:

1. Division 2, Site Work.

1.2 Quality Assurance

A. All Work done under this Section shall be performed by a lightning protection contractor regularly engaged in the installation of Master Labeled lightning protection systems and who is approved for such Work by the Underwriters' Laboratories.

B. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:

1. National Electrical Code.
2. NFPA 780 - Standard for the Installation of Lightning Protection Systems.

1.3 Submittals

A. Shop Drawings: Submit the following for approval:

1. Layouts showing the lightning protection system for the facilities. These shall be "working drawings" produced by the lightning protection contractor. A copy of the Contract Drawings is not acceptable.
2. Manufacturer's technical information for the materials proposed for use in the systems.

PART 2 - PRODUCTS

2.1 Materials

- A. Primary Roof conductor: Tinned, copper conductor 32 strands of 17 gauge. 65,600 circular mils, 215 lbs. per 1000 ft. Heary Bros. cat. #HB32-17CTI or equal.
- B. Secondary Bonding Conductor: Tinned, copper conductor 14 strands of 17 gauge, 28,500 circular mils, 92 lbs. per 1000 ft. Heary Bros cat. #HB6-CTI or equal.
- C. Down Conductor: Tinned, copper conductor 28 strands of 13 gauge, 131,500 circular mils, 420 lbs per 1000 ft. Heary Bros cat. #HB28-13CTI (tin plated copper) or equal.
- D. Copper heavy duty straight splicer from cables 2/0 through 4/0. Heary Bros. Cat #HB-27-CTI or equal.
- E. Air Terminal and Base:
 - 1) 5/8" dia x 24" solid Tinned copper air terminal with pan type spring support base. Heary Bros. cat. #HBSOL-316CTI, HB38XX-CTI & HB1955 or equal.
 - 2) 5/8" dia x 24" solid tinned copper air terminal with offset parapet air terminal base. Heary Bros. cat. #HBSOL-316CTI and HB32CTI or HB1955 or equal.
 - 3) 1/2" dia x 48" solid tinned copper air terminal with vertical air terminal base. Heary bros. cat. #HBSOL-306CTI and HB22CTI, attached to pipe with 2 @ 10" dia. straps Heary Bros cat. #HB-97CTI or equal.
 - 4) Provide air terminal point shield number J15N13C by Northeast Lightning Protection Systems, Inc. or equal for all terminals on interior part of roof

and for any terminals on the perimeter of the roof located near access ladders.

- F. Bare Ground Cable: Annealed, bare, stranded copper, No. 4/0 AWG minimum size by Wire and Cable Division of Anaconda Company, General Cable Corporation, or equal.
- G. Ground Rods: Solid copper rods, 3/4 inch diameter, 10 feet long unless otherwise noted on the Drawings. Heary Bros.. cat. #HB-SOL 107CRXX or equal. Furnish and install an inspection test well for each ground rod. Test well shall be vitreous clay, 12 inches diameter, with cast iron gray cover, rated for H2O loading.
- H. Flashing connection Heary Bros.. cat. #HB-43CTI or equal.
- I. Vent pipe connection Heary Bros. cat #HB-100XCTI or equal.
- J. Roof drain connection Heary Bros.. cat. #HB-58XCTI or equal.
- K. Bonding plate connection Heary Bros.. cat. #HB-54CTI or equal.
- L. Cable connection Heary Bros.. cat. #HB-44CTI, HB-52CTI or equal.
- M. Cable fasteners Heary Bros.. cat. #HB-66CTI, HB-72CTI or equal.
- N. Water line connection Heary Bros.. cat. #HB97CTI, HB-57CTI or equal.

PART 3 - EXECUTION

3.1 Installation

- A. Install a continuous cable loop on the roof interconnecting air terminal(s) to ground terminals per NFPA 780. Install air terminals on roof, fan housings and all equipment as required by NFPA 780.
- B. Fasten roof cables per NFPA 780.
- C. Bond all metal pipes and roof mounted metal structures to the roof loop or to the down lead cables.

- D. Bond any building steel framework to the down cables.
- E. Install two foot high air terminals per NFPA 780.
- F. Weld all buried connections. Buried bolted connections are not permitted. Welded connections to be made by exothermic process utilizing molds, cartridges and hardware designed specifically for the connection to be made.
- G. Coordinate all work with site work by other trades and suppliers. Special attention is directed to air terminal and conductor installation on the HVAC equipment and roof coordinate with roofing installation to ensure warranty and integrity of roof.
- H. Protect all down conductors to prevent physical damage or displacement per NFPA 780. Installation of conductors, conduits and fasteners shall not cause a tripping hazard to personnel.
- I. Each grounding system (underground metallic piping systems, etc.) shall be bonded together.
- J. All air terminals shall be installed in the vertical position.

3.2 Testing

- A. Test the complete system for continuity and for resistance to ground.
- B. Inspect the system for proper installation.
- C. Inspection and testing to be performed by personnel regularly engaged in the installation and testing of Master Labeled lightning protection systems.

+ + END OF SECTION + +

SECTION 16770

ELECTRIC HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide electric unit heaters and convection heaters complete with accessories including mounting brackets as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. General and Special Conditions.
 - 2. Section 16925, Control Stations.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
 - 1. Underwriters Laboratories, Incorporated.
 - 2. National Electrical Code (NEC).
 - 3. Local and State Building Codes and Ordinances.
 - a. New York State Uniform Fire Prevention and Building Code.
 - b. New York State Energy Conservation Code.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. Air Moving and Conditioning Association (AMCA).
 - 2. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).

3. National Electrical Manufacturers Association (NEMA).

4. National Fire Protection Association (NFPA).

C. Units must bear UL label.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Dimensions.

2. Capacities.

3. Materials of Construction.

4. Finishes.

5. Manufacturer's literature, illustrations, specifications and engineering data.

6. Interconnecting wiring diagrams.

B. Test Reports: Submit the following test certifications for approval.

1. UL Label.

C. Operation and Maintenance Data:

1. Furnish O&M manuals in accordance with the General and Special Clauses.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store equipment inside and keep clean and free from damage.

B. Handle to prevent damage during installation and storage.

PART 2 - PRODUCTS

2.1 DESIGN CONDITIONS

- A. Design conditions shall be as indicated on the Drawings.

2.2 DETAILS OF CONSTRUCTION

- A. Electric Unit Heaters (type EUH in dry locations, type EUH-SS in corrosive locations):

- 1. Casing:

- a. Material: 18 gauge die formed steel and finished in high gloss baked enamel in dry locations (type EUH heaters), 16 gauge stainless steel in corrosive locations (type EUH-SS heaters).
- b. Fabrication: Front and back halves joined together at top and bottom.
- c. Mounting: Provided with wall hanger bracket. Mounting brackets shall be dip painted with a corrosion resistant primer in dry locations (type EUH heaters). Mounting brackets shall be stainless steel in corrosive locations (type EUH-SS heaters).

- 2. Construction:

- a. Cast Aluminum with nickel chromium resistance wire or finned resistance elements in dry locations (type EUH heaters). Stainless steel resistance elements in corrosive locations (type EUH-SS heaters).
- b. Integral thermal limit switch.
- c. Maximum operating temperature: 400° F at 70°F ambient.
- d. Suitable for operation on 480V, 3 phase service, as scheduled.

3. Fans:

- a. Type: Broad blade axial flow-type design.
- b. Construction: Aluminum.
- c. Attached to steel hub.
- d. Dynamically balanced.

4. Motors:

- a. Type: Single speed.
- b. Enclosure: Totally enclosed.
- c. Mounting: Resilient mounted.
- d. Bearings: Permanently lubricated, sealed bearings.
- e. Overload Protection: Provide integral overload protection.
- f. Capacity: To match fan requirements.
- g. Produced, rated, tested in accordance with NEMA standards.
- h. Suitable for 40 C ambient temperature.

5. Air deflectors:

- a. Horizontal type.
- b. Adjustable for downward, upward or straight air flow.

6. Capacity: As shown on the Schedule.

7. Thermostats (Remote):

- a. Construction: Rugged thermoplastic, NEMA 4X rated. Exposed portion of the liquid-filled sensing elements shall be plated and plastic coated to resist damage in corrosive atmospheres.

- b. Range: 30° to 110°F with an adjustable differential of 3° to 12°F.
 - c. Contact: Output shall be single pole double throw switch rated 16.0 AC full load amperes, 96.0 AC locked rotor amperes and 16.0 amperes resistive at 120 volts AC.
 - d. Products and Manufacturers: Johnson Controls Model A19PRC-1C, or equal.
8. Thermostats (Integral): Field installable and replaceable, 40° to 90°F range.
9. Control Transformers: Built-in for 24-volt operation with 24-volt relay-holding coil.
10. Fan delay switches.
11. Contactors: Built-in heavy duty 600 volt.
12. Products and Manufacturers:
- a. Type EUH: Modine type HE; Chromalox type LUH; or approved equal.
 - b. Type EUH-SS: Valad Electric Heating Corp. type 206, 207, 209 or 210 depending on wattage, telephone number 914-631-4927); or approved equal.

2.3 SPARE PARTS

- A. Provide four spare fuses of each size and type.

PART 3 - EXECUTION

3.1 HEATER SCHEDULE

Drawing Designation	Location	Rating	Voltage	Type
EUH-1	Well Building, Lime Room	3 kw	480V, 3 Phase	EUH-SS
EUH-2	Well Building, Phosphate Room	3 kw	480V, 3 Phase	EUH-SS

Legend:

EUH - Electric Unit Heater (dry locations)
EUH-SS - Electric Unit Heater - stainless steel construction
(corrosive locations)

3.2 THERMOSTATS

A. Heaters shall have remote thermostats.

3.3 INSPECTION

A. Inspect units for damage prior to installation and correct if necessary as recommended by manufacturer.

3.4 INSTALLATION

A. Install cabinets level and plumb.

B. Mounting hardware, including supplementary brackets and supports, shall be stainless steel.

C. Install units in accordance with details on the Drawings and approved Shop Drawings.

D. Install thermostats on 3/4" plywood backboard.

E. Complete electrical connections as shown.

3.5 CLEANING

A. Clean tar, cement or other dirt from units.

B. Remove debris and other waste material resulting from installation.

3.6 ADJUSTMENTS

A. Set air deflectors for proper air delivery.

B. Set thermostat for required setting.

+ + END OF SECTION + +

SECTION 16920

MOTOR CONTROL CENTERS AND VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work:

1. The Contractor shall furnish all labor, materials, equipment and incidentals required to provide new Motor Control Centers as shown and specified.
2. The VFDs shall be inverter type, variable torque, suitable for use with the pumps and blowers.
3. The VFDs shall be mounted in motor control center lineups as shown and described herein.
4. The VFDs for the booster pumps and blower shall have reduced voltage, solid state bypass motor starters.
5. The VFDs for the transfer pumps shall have across-the-line bypass motor starters.
6. Each of the booster pumps shall be controlled as follows:
 - a. There shall be a Hand-Off-Remote selector switch on the VFD compartment. In the "Hand" position, the pump shall operate. In the "Off" position, the pump shall not operate. In the "Remote" position, the pump shall operate based on a "run" command (normally open dry contact, closed to call for pump operation) from the Packed Tower Aeration System Control Panel.
 - b. For speed control, there shall be a VFD-Remote selector on the VFD keypad. In the "VFD" position, the speed shall be controlled from the VFD keypad. In the "Remote" position, the speed shall be

controlled from a remote 4-20 mA signal from the Packed Tower Aeration System Control Panel.

- c. There shall be a VFD-Bypass selector switch on the VFD enclosure. In the "VFD" position, the VFD shall control the pump. In the "Bypass" position, the bypass motor starter shall control the pump at constant speed.
 - d. There shall be a pressure switch on the pump discharge that shall shut down the pump on a high pressure condition. Provide "high pressure shutdown" indication on VFD.
 - e. The VFD/RVSS bypass shall provide a run signal (normally open dry contact, closed for pump operating) to the Booster Pump Chemical Safety Panel for pump on/off status.
 - f. The VFD shall provide a run signal (normally open dry contact, closed for pump operating), fail signal (normally closed dry contact, open for fail), a 4-20 mA DC signal for operating speed and a 4-20 mA DC signal for running amps to the Packed Tower Aeration System Control Panel.
 - g. The VFD control circuit shall latch all of the alarms and shutdown conditions until manually reset. A reset button shall be provided. Logic shall be provided in order that the alarms and shutdown conditions do not have to be manually reset after a power failure.
 - h. The VFD/RVSS compartment shall include an emergency stop pushbutton, elapsed time meter, on/off pilot lights and a three-phase ammeter with selector switch.
7. Each of the Transfer Pumps shall be controlled as follows:
- a. There shall be a Hand-Off-Remote selector switch on the VFD compartment. In the "Hand" position, the pump shall operate. In

the "Off" position, the pump shall not operate. In the "Remote" position, the pump shall operate based on a "run" command (normally open dry contact, closed to call for pump operation) from the Packed Tower Aeration System Control Panel.

- b. For speed control, there shall be a VFD-Remote selector on the VFD keypad. In the "VFD" position, the speed shall be controlled from the VFD keypad. In the "Remote" position, the speed shall be controlled from a remote 4-20 mA signal from the Packed Tower Aeration System Control Panel.
 - c. There shall be a VFD-Bypass selector switch on the VFD enclosure. In the "VFD" position, the VFD shall control the pump. In the "Bypass" position, the bypass RVSS motor starter shall control the pump at constant speed.
 - d. The VFD shall provide a run signal (normally open dry contact, closed for pump operating), fail signal (normally closed dry contact, open for fail), a 4-20 mA DC signal for operating speed and a 4-20 mA DC signal for running amps to the Packed Tower Aeration System Control Panel.
 - e. The VFD control circuit shall latch all of the alarms and shutdown conditions until manually reset. A reset button shall be provided. Logic shall be provided in order that the alarms and shutdown conditions do not have to be manually reset after a power failure.
 - f. The Transfer Pump VFD/RVSS compartment shall include an emergency stop pushbutton, elapsed time meter, on/off pilot lights and a three-phase ammeter with selector switch.
8. Each of the Blowers shall be controlled as follows:

- a. There shall be a Hand-Off-Remote selector switch on the VFD compartment. In the "Hand" position, the pump shall operate. In the "Off" position, the pump shall not operate. In the "Remote" position, the pump shall operate based on a "run" command (normally open dry contact, closed to call for pump operation) from the Packed Tower Aeration System Control Panel.
- b. For speed control, there shall be a VFD-Remote selector on the VFD keypad. In the "VFD" position, the speed shall be controlled from the VFD keypad. In the "Remote" position, the speed shall be controlled from a remote 4-20 mA signal from the Packed Tower Aeration System Control Panel.
- c. There shall be a VFD-Bypass selector switch on the VFD enclosure. In the "VFD" position, the VFD shall control the blower. In the "Bypass" position, the bypass motor starter shall control the blower at constant speed.
- d. Each blower motor will have a power disconnect switch, with auxiliary contacts for switch position. The VFD shall have provisions to accept the normally closed contact (open when disconnect switch is open and power is disconnected to the motor) to enable the VFD.
- e. The VFD shall provide a run signal (normally open dry contact, closed for pump operating), fail signal (normally closed dry contact, open for fail), a 4-20 mA DC signal for operating speed and a 4-20 mA DC signal for running amps to the Packed Tower Aeration System Control Panel.
- f. The VFD control circuit shall latch all of the alarms and shutdown conditions until manually reset. A reset button shall be provided. Logic shall be provided in order that the alarms and shutdown conditions do

not have to be manually reset after a power failure.

- g. Each blower VFD/RVSS compartment shall contain an over/under current relay that shall provide a normally closed dry contact (open on under current) to the Packed Tower Aeration Control Panel.
9. The VFDs furnished (or similar earlier generation VFDs by the same manufacturer) shall have been used for a minimum of 10 years in similar wastewater pumping applications.
10. Furnish VFDs in accordance with the following schedule:

<u>Equipment</u>	<u>Motor HP</u>	<u>Voltage</u>	<u>Bypass</u>	<u>Quantity</u>	<u>Maximum Dimensions</u>
Booster Pumps	100	480	RVSS	2	MCC-PT1
Transfer Pumps	20	480	Across-the-Line	2	MCC-PT2
Blowers	60	480	RVSS	2	MCC-PT2

Note: The VFDs shall be incorporated in motor control centers as noted.

B. Coordination:

1. Review installation procedures under other sections and coordinate the Work under this section accordingly.

C. Related Work Specified Elsewhere:

1. Refer to General and Specific Clauses for guarantees, shop drawings, technical manuals, etc.
2. Section 18380, Packed Tower Aeration System Control Panel.
3. Section 18400, Water Treatment Chemical Safety.
4. Section 18500, SCADA System Work.

5. Division 16, Electrical.

1.2 QUALITY ASSURANCE

- A. The AC drives and all options shall be UL listed according to Electric Industrial Control Equipment Specification UL 508C. A UL label shall be attached inside each enclosure as verification.
- B. The AC drives shall be designed, constructed and tested in accordance with NEMA, NEC and VDE standards.
- C. The manufacturer of the AC drives shall be a certified ISO 9002 facility.
- D. The motor control centers shall comply with the applicable provisions and recommendations of the following except where otherwise shown or specified:
 - 1. NEMA AB-1, Molded Case Circuit Breakers
 - 2. NEMA ICS 1, General Standards for Industrial Control
 - 3. NEMA ICS 2, Standard for Industrial Control Devices, Controllers and Assemblies
 - 4. UL 489, Standard for Molded Case Circuit Breakers and Circuit Breaker Enclosures
 - 5. UL 508, Standard for Industrial Control Equipment
 - 6. UL 845, Standard for Motor Control Centers

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval manufacturer's technical information, including the following:
 - 1. Catalog cuts of all components.
 - 2. Enclosure detail, including dimensions.
 - 3. Schematic diagrams and interconnecting wiring diagrams.
 - 4. Graphical screens for operation interface terminals.

5. Remote control panels and control stations.
 6. Written description of system operation.
 7. Installation instructions.
 8. Recommended spare parts list.
- B. Operation and Maintenance Manuals: Submit for approval operation and maintenance manuals in accordance with the requirements of Section 01730, Operation and Maintenance Data, and the General and Supplementary Conditions.

1.4 SPARE PARTS

- A. The Contractor shall furnish all spare parts with the equipment, neatly wrapped or boxed, indexed and tagged with complete information for use and reordering.
- B. Spare Parts: Supply the following:
1. One VFD of each size.
 2. One control power transformer of each type.
 3. Four relays of each type (including phase failure, time delay and control relays).
 4. Six fuses of each type.
 5. One set of air filters for each VFD.

PART 2 - PRODUCTS

2.1 MOTOR CONTROL CENTERS

- A. General: Motor control center lineups shall be provided as described herein and on the Drawings.
1. Service: Motor control center shall operate from a 480 volt, 3 phase, 60 Hertz system.
 2. Wiring: NEMA Class II, Type B.
 3. Enclosure: NEMA 12 Gasketed.
 4. Finish: ANSI 49 medium gray.

B. Construction:

1. Totally enclosed structure, dead front, consisting of nominal 20-inch wide, 90-inch high vertical sections bolted together to form a unit assembly. Depth shall be as shown on the drawings.
2. Removable lifting angles for each shipping section.
3. Shipping sections shall be limited as required to pass through doorway. See Drawings for size of doorway.
4. Two removable floor sills for mounting.
5. Horizontal wireways top and bottom, isolated from horizontal bus and readily accessible.
6. Isolated vertical wireways with cable supports, accessible through hinged doors separate from the controller units.
7. All metal nonconducting parts electrically continuous.
8. Structure shall be completely gasketed, including unit doors, bottom plates, and cover plates.

C. Bus System:

1. Bus bracing shall be 65,000 amps RMS symmetrical minimum.
2. All bus bars shall be tin plated copper and rated for UL heat rise standards.
3. Main Horizontal Bus: Continuous, edge mounted, and isolated from wireways and working areas, 800 Amp minimum, continuous rating.
4. Vertical Bus: Continuous, and isolated by a glass polyester barrier, 300 Ampere minimum continuous rating.
5. Grounding Bus: Full capacity, full length mounted across the bottom, drilled with lugs of appropriate capacity as required.

6. Neutral Bus: Full capacity, full length across the motor control center lineup (where indicated for a specific motor control center).
7. Bus bar connections easily accessible and maintainable with simple tools.

D. Unit Compartments:

1. Individual front door for each unit compartment with engraved nameplate identifying equipment. Nameplates to be 1-inch by 3 inches minimum secured to unit door with two screws. Engraved letters shall be 1/2-inch high.
2. Starter and feeder-unit doors interlocked mechanically with the unit disconnect device to prevent unintentional opening of the door while energized and unintentional application of power while door is open, with provisions for releasing the interlock for intentional access and/or application of power.
3. Padlocking arrangement permitting locking the disconnect device in the OFF position with at least three padlocks with the door closed or open.
4. Provide main circuit breakers with auxiliary back contact to close when breaker closes, wired to auxiliary device for interlocking, where shown on the Drawings.
5. Minimum motor starter size shall be NEMA 1. Starter units completely draw out type in Sizes 1 and 2 and draw out type after disconnecting power leads only in Sizes 3 and 4.
6. Motor starters shall include a magnetic contactor, NEMA rated with encapsulated magnet coils. Wound coils are not acceptable.
7. Overload Relays: Three melting alloy type, manually reset from outside the enclosure by means of an insulated button with normally open auxiliary contact for remote alarm purposes and separate heater elements sized for the full load amperes of the actual motors furnished.

8. Individual control power transformers for all starters, capacity as required for all control circuit devices, 100VA minimum, 120 volt secondary with two primary fuses, one secondary fuse and the other secondary leg grounded. Transformers shall have Class A insulation.
9. Separate Control: Where control power is provided by a separate power source a control power fuse shall be provided in the unit and the main disconnect shall be equipped with a normally open contact to isolate the control circuit from the source when the controller disconnect is open.
10. Motor horsepowers shown are preliminary. Circuit breaker trips and starter overload heaters to be coordinated with the actual equipment installed. Obtain all motor data for equipment furnished.
11. Auxiliary contacts, relays, timers shall be provided as required for the control functions shown on the Drawings and/or specified.
12. Provide starter devices, including spare contacts wired to numbered terminal blocks.
13. Control devices shall be 600 volt heavy duty, NEMA A600. Relays shall have convertible contacts. Pilot devices shall be oil tight. Pilot lights shall be push-to-test, L.E.D., transformer type with 6 volt secondary.
14. Main and Feeder Circuit Breakers: Thermal magnetic type, 100 Amp minimum frame, 65,000 amp I.C.S. minimum at 480 volt.
15. Combination Motor Starter Circuit Breakers: Magnetic trip only motor circuit protectors, 65,000 amp I.C.S. minimum at 480 volt.
16. Bus Metering (Microprocessor Based):
 - a. The new motor control center in the Booster Building shall contain microprocessor based three-phase metering to monitor and display phase currents, voltage (line-line, line-neutral), real power and reactive apparent power, power factor, frequency, energy (watt

hours, VAR- hours, and VA-hours) and total harmonic distortion readings for voltage and current.

- b. The metering device shall have one normally open and one normally closed contact for power failure condition.
 - c. Ethernet output for transmission of phase to phase voltages and amperage on each phase to SCADA.
17. Motor control center shall be furnished with a phase failure relay on the normal side of the automatic transfer switch for PSEG power fail alarm.
18. Under Current Monitors: The blower motor starter shall be furnished with an over/under current monitor to detect if the blower is running unloaded (broken belt, etc.). Monitor shall be Time Mark 2742 series, or approved equal.
19. Surge Suppressor/Filter:
- a. On each motor control center bus of the main-tie-main sections, furnish a surge suppression and filtering system. Suppression system shall utilize metal oxide varistors and shall conform to UL 1449 requirements. Single pulse surge current capacity shall be 200,000 amps per phase. The filtering system shall conform to UL 1283 requirements.
 - b. Each surge suppresser/filter shall be housed in a NEMA size 1 stab-in MCC housing. Ground lug and neutral lug shall be furnished as required.
 - c. Each surge suppresser/filter shall include an integral fused disconnect switch.
 - d. Surge suppresser/filtering systems shall be Model 202XT as manufactured by MCG Surge Protection, or approved equal.

E. Product and Manufacturer: Provide equipment manufactured by one of the following, latest design:

1. Square D
2. General Electric
3. Allen-Bradley
4. Or approved equal

The motor control centers shall be of the same manufacturer as the variable frequency drive manufacturer to ensure uniformity and single source responsibility.

- F. Size Limitation: The Contractor is advised that the overall dimensions of the motor control centers shown on the contract drawings are regarded as critical, "not to exceed" dimensions, and have been confirmed as feasible with several manufacturers. Submittals of motor control center shop drawings with greater dimensions than those shown will result in immediate disapproval.

2.2 VARIABLE FREQUENCY DRIVES

A. Features:

1. The VFDs shall be rated 480V AC. The VFD shall provide microprocessor-based control for three-phase induction motors.
2. The VFDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable current source VFDs are not acceptable. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar junction transistors, GTOs or SCRs are not acceptable.
3. The VFDs shall have an efficiency at full load and speed that exceeds 95%. The efficiency shall exceed 90% at 50% speed and load.
4. The VFDs shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.

5. The VFDs shall have a one (1) minute overload current rating of 150% for constant torque drives. The VFD shall have a one (1) minute overload current rating of 110% for variable torque drives.
6. The VFDs shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.
7. The VFDs shall be able to start into a spinning motor. The VFDs shall be able to determine the motor speed in any direction and resume operation without tripping.
8. Standard operating conditions shall be:
 - a. Incoming power: Three-phase, 480 V AC, +10% to -15%, and 50/60 Hz (± 5 Hz) power to a fixed potential DC bus level
 - b. Frequency stability of $\pm 0.5\%$ for 24 hours with voltage regulation of $\pm 1\%$ of maximum rated output voltage
 - c. Speed regulation of $\pm 0.5\%$ of base speed
 - d. Load inertia dependant carryover (ride through) during utility loss
 - e. Insensitive to input line rotation
 - f. Humidity: 0 to 95% (non-condensing and non-corrosive)
 - g. Altitude: 0 to 3,300 feet (1000 meters) above sea level
 - h. Ambient temperature: -10 to 50 degrees C (constant torque), -10 to 40 degrees C (variable torque)
 - i. Storage temperature: -40 to 60 degrees C.

B. Control Functions:

1. Frequently accessed VFD programmable parameters shall be adjustable from a digital operator

keypad located on the front of the VFD. The VFD shall have a three-line alphanumeric programmable display with status indicators. Keypads shall use plain English words for parameters, status, and diagnostic messages. Alphanumeric codes and tables are not acceptable.

2. Standard advanced programming and troubleshooting functions shall be available by using a personal computer's (PC's) communication port and Windows® based software. In addition the software shall permit control and monitoring via the VFD's communication port. The manufacturer shall supply the required software.
3. The operator shall be able to scroll through the keypad menu to choose between the following:
 - a. Monitor
 - b. Operate
 - c. Parameter setup
 - d. Actual parameter values
 - e. Active faults
 - f. Fault history
 - g. LCD contrast adjustment
 - h. Information to indicate the standard software and optional features software loaded.
4. The following setups and adjustments, at a minimum, are to be available:
 - a. Start/stop command from keypad, remote or communications port
 - b. Speed command from keypad, remote or communications port
 - c. Motor rotation selection
 - d. Maximum and minimum speed limits

- e. Acceleration and deceleration times, two settable ranges
- f. Critical (skip) frequency avoidance
- g. Torque limit
- h. Multiple attempt restart function
- i. Multiple preset speeds adjustment
- j. Catch a spinning motor start or normal start selection
- k. Programmable analog output
- l. Proportional/integral process controller.

C. System Interfaces:

- 1. Inputs - A minimum of six (6) programmable digital inputs, two (2) analog inputs and serial communications interface shall be provided with the following available as a minimum:
 - a. Remote manual/auto
 - b. Remote start/stop
 - c. Remote forward/reverse
 - d. Remote preset speeds
 - e. Remote external trip
 - f. Remote fault reset
 - g. Process control speed reference interface, 4-20 mA_{dc}
 - h. Potentiometer and 1-10V DC speed reference interface
 - i. Communications port
- 2. Outputs - A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1)

programmable analog output shall be provided, with the following available at minimum.

a. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:

- 1) Fault
- 2) Run
- 3) Ready
- 4) Reversing
- 5) Jogging
- 6) At speed
- 7) In torque limit
- 8) Motor rotation direction opposite of commanded
- 9) Over temperature.

b. Programmable analog output signal, selectable with the following available at minimum:

- 1) Output current
- 2) Output frequency
- 3) Motor speed
- 4) Motor torque
- 5) Motor power
- 6) Motor voltage
- 7) DC link voltage

D. Monitoring and Displays:

1. The VFDs display shall be a LCD type capable of displaying three (3) lines of text and the following thirteen (13) status indicators:

- a. Run
- b. Forward
- c. Reverse

- d. Stop
 - e. Ready
 - f. Alarm
 - g. Fault
 - h. Local
 - i. Panel
 - j. Remote
 - k. Hand
 - l. Auto
 - m. Off
2. The VFDs display shall be capable of displaying the following monitoring functions at a minimum:
- a. Output frequency
 - b. Output speed
 - c. Motor current
 - d. Motor torque
 - e. Motor power
 - f. Motor voltage
 - g. DC-link voltage
 - h. Heatsink temperature
 - i. Total operating days counter
 - j. Operating hours (resettable)
 - k. Voltage level of analog input
 - l. Current level of analog input
 - m. Digital inputs status
 - n. Digital and relay outputs status

3. Protective Functions:

a. The VFDs shall include the following protective features at minimum:

- 1) Overcurrent
- 2) Overvoltage
- 3) Inverter fault
- 4) Undervoltage
- 5) Phase loss
- 6) Output phase loss
- 7) Undertemperature
- 8) Overtemperature
- 9) Motor stalled
- 10) Motor overtemperature
- 11) Motor underload
- 12) Logic voltage failure
- 13) Microprocessor failure
- 14) The VFDs shall provide ground fault protection during power-up, starting, and running. VFDs without ground fault protection during running are not acceptable.

4. Diagnostic Features:

a. Fault History:

- 1) Record and log faults.
- 2) Indicate the most recent first, and store up to 9 faults.

E. VFD Accessories:

1. Thermal magnetic circuit breaker, 65,000-amp interrupting capacity on the line side of the VFD to provide a disconnecting means. Operating handle shall protrude from the door. The handle position shall indicate ON, OFF and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent

unauthorized opening or closing of the VFD door with the disconnect handle in the ON position. This shall be defeatable by maintenance personnel.

2. Bypass Control Circuitry:

- a. Controls to bypass the VFD shall be mounted integrally to each VFD enclosure.
- b. The bypass shall utilize an input circuit breaker to isolate the bypass starter (reduced voltage solid state starter or across-the-line starter as required herein) and bypass contactor from the variable frequency drive.
- c. An output contactor, NEMA rated for pump motor horsepower, shall be electrically and mechanically interlocked with the contactor on the load side of the VFD.

3. Solid State Reduced Voltage Starters:

- a. Solid state starters shall be U.L. listed.
- b. Solid state starters shall be of the voltage ramping type.
- c. The starting current shall be adjustable from 100% to 400% of motor full load current.
- d. The starting ramp period shall be adjustable from 2 to 30 seconds.
- e. The current limit shall be adjustable from 100% to 400% of motor full load current.
- f. The voltage shall be reduced at motor terminals when the motor is running at no load or is lightly loaded.
- g. There shall be six SCRs, two per phase.
- h. Adjust all settings as recommended by the pumping equipment manufacturer to suit the engineer.

- i. Starters shall be rated heavy duty. Horsepower ratings shall be as required for pump motors.
- j. The starters shall include over temperature protection, shorted SCR protection, and phase imbalance/phase loss protection.
- k. The starters shall include metal oxide varistors for transient protection.
- l. If any of the conditions described in "j" occurs, an overload is detected from the bimetallic overload relay, or phase failure is detected from the phase failure relay, starting of the motor shall be inhibited or the solid state starter shall be shut down if operating.
- m. Each starter shall include a HMCP Motor Circuit Protector for short circuit protection. Continuous recurrent rating shall be as required for the motor. Interrupting rating shall be 65,000 amps symmetrical at 480 volts.
- n. Each starter shall be furnished with an externally operable hand reset ambient compensated bimetallic overload relay with heaters sized per motor full load current. Overload relay shall have a spare normally open contact.
- o. Provide the following accessories for each starter:
 - 1) One normally open and one normally closed auxiliary motor run contacts.
 - 2) One normally open and one normally closed contact to signal solid state starter alarm condition (over temperature, shorted SCR).
 - 3) LEDs for fault condition, running, starting and stopping (integral to starter).
 - 4) Master terminal strip for all remote connections.

- o. The VFD and bypass circuit breakers shall be operated with "through the door" rotary operators.
- 7. Control power transformers, as required, with fused primary and secondary.
- 8. Time delay, adjustable 0-60 seconds, for motor starting (capability of staggered starting of equipment).
- 9. Elapsed time meters shall be synchronous motor type with digital readout counter for panel mounting. The register shall read 0-99,999.9 hours and shall be nonreset, 3 1/2" wide.
- 10. Current transformers on the 480 volt input to the VFD (line side of circuit breakers for VFD and bypass for contactor).
- 11. Surge Protection:
 - a. Line-to-line and line-to-ground protection shall be provided. This protection shall exceed the requirements of ANSI/IEEE standard C62.1-1984 section 8.6.1 and 8.7.3 by a factor of at least 300%.
 - b. Voltage clamping time shall be less than 5 nanoseconds with a maximum surge current of 30,000A RMS at a clamping voltage 552 VAC.
 - c. Clamping voltage levels shall be specifically sized for the applied system voltage as well as the winding and grounding configuration of the supply transformer. These voltage levels will be chosen to assure minimizing system voltage excursion.
 - d. One arrestor complete with circuit breaker disconnect, is to be supplied at the input of the VFD.
 - e. Unit shall be manufactured by Ingram Products, or equal.

12. Phase Monitor:

- a. A phase monitor shall be provided at the input of the VFD.
- b. The phase monitor shall be at a minimum, protect against the following conditions:
 - 1) overvoltage
 - 2) undervoltage
 - 3) phase reversal
 - 4) phase imbalance
 - 5) loss of phase
- c. The phase monitor shall have an integral fault light as well as (1) form-C isolated contact for alarm indication.
- d. Unit shall be manufactured by Diversified, or equal.

13. Master terminal strip for all remote connections.

14. Handheld terminal with cable which can be used to troubleshoot and interrogate programming panel. VFD shall have connector for terminal cable. One handheld terminal shall be furnished.

15. Reactors:

- a. Furnish and install a line reactor, 5% impedance, on the input to each VFD.

F. VFD Enclosure:

- 1. The VFDs shall be housed in NEMA 12 ventilated motor control centers.

G. Manufacturer:

- 1. Variable frequency drives shall be Square D, Allen-Bradley Powerflex 700, General Electric/Fuji, or approved equal. VFD furnished shall be the current generation model by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION AND STARTUP

- A. The Contractor shall furnish the services of the VFD manufacturer's engineer during start up for commissioning of the VFDs. Written certification shall be furnished that the equipment has been installed properly and is operating properly.
- B. The Contractor shall furnish manufacturer's certification that the VFDs are suitable for controlling the equipment served.
- C. During startup, the VFDs shall be configured for the parameters of the mechanical equipment and motors (motor full load current, acceleration time, deceleration time, etc.). This shall also include setting the carrier frequency to minimize noise and stress on the motors and scaling the dc input signals.

3.2 TRAINING

- A. The VFD manufacturer shall provide on-site training program for the Owner's personnel. This program shall provide operating and instruction manuals, training in equipment operation, and troubleshooting of the VFD. Vendor shall coordinate training program with Engineer. A minimum of 2 days of instruction shall be provided.

3.3 COORDINATION

- A. The Contractor shall coordinate the VFDs with the mechanical equipment and control systems. This includes interconnecting wiring diagrams, operational requirements, etc.

3.4 INSTALLATION

- A. General Contractor shall install concrete pad for VFDs as shown on the Drawings.
- B. When installing VFDs, maintain clearances as per manufacturer's recommendations.

3.5 GUARANTEE

- A. The equipment furnished under this Section shall be guaranteed for period of two (2) years from the date of substantial completion, against defective materials, designs and workmanship, unless otherwise noted. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced promptly by and at the expense of the Vendor.

+ + END OF SECTION + +

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SECTION 16925

CONTROL STATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide pushbuttons, selector switches, thermostats and other control stations as shown and specified.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except where otherwise shown or specified:

- 1. NEMA ICS 5, Control Circuit and Pilot Devices.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical information for control stations proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Control Stations:

- 1. Type: Industrial, heavy duty, oil tight construction with clearly marked legend plates.
- 2. Pushbuttons: Momentary or maintained types as shown on the Drawings. NEMA A600 contact rating.
- 3. Lock-out Stop: Two push-button maintained contact type with locking feature.
- 4. Selector Switches: Rotary type with round or oval handles and positioning device to securely hold switch in selected position.

- a. Hand-off-auto switches at motor locations shall have additional contact blocks for hand and auto position status at local panels, as indicated on the Contract Drawings.
 - b. Jog-auto-off switches shall be spring return to off from jog.
5. Indicating Lights: Transformer type with 6 volt lamp. Lens color green for running, red for stopped, ready or failure, push to test.
6. Enclosures: NEMA 12 cast iron for dry locations, NEMA 4X stainless steel for damp locations and NEMA 4X fiberglass for corrosive locations.
7. Certain additional features for individual control stations shall be provided as indicated on the Contract Drawings or on the Schematic Diagrams.
8. Product and Manufacturer: Provide equipment manufactured by one of the following:
 - a. Square D.
 - b. General Electric Company.
 - c. Allen Bradley.
 - d. Crouse-Hinds Company.
 - e. Appleton Electric Company.
 - f. Or approved equal.

B. Thermostats:

1. Construction: Rugged NORYL plastic, NEMA 4X rated. Exposed portion of the liquid-filled sensing elements shall be plated and plastic coated to resist damage in corrosive atmospheres.
2. Range: 30° to 110°F with a differential of 3° to 12°F.

3. Contact: Output shall be single pole double throw switch rated 16.0 AC full load amperes motor load, 96 locked rotor amperes at 120 volts AC.
4. Products and Manufacturers" Provide one of the following: Johnson Controls Model A19PRC-1C, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount equipment so that sufficient access and working space is provided for safe operation and maintenance.
- B. Securely fasten equipment to walls or other surfaces on which they are mounted. Provide independent supports (galvanized steel in dry locations, stainless steel in damp and corrosive locations) where no wall or other surface exists.

+ + END OF SECTION + +

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DIVISION 18 - PLUMBING

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SECTION 18001

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: The Plumbing Contractor shall furnish all labor, materials, equipment and incidentals required to complete the plumbing work as shown and specified. The scope of work for the Plumbing Contract is defined in Section 01010, Summary of Work.
- B. Coordination:
 - 1. Review installation procedures under other Sections of these specifications and coordinate the installation of items that must be installed with the site work, building construction work, formwork, walls, partitions and ceilings.
 - 2. Coordinate the plumbing work with the work by others.
 - 3. Specific additional coordination requirements are outlined in Section 01010, Summary of Work.
- C. General:
 - 1. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment furnished with the space allocated for that equipment.
 - 2. The Drawings show the principal elements of the plumbing installation. They are not intended as detailed working drawings for the plumbing work but as a complement to the Specifications to clarify the principal features of the plumbing systems.
 - 3. It is the intent of this Section that all piping and valves, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment so as to

render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.

4. Mounting heights of piping and valves noted in the Specifications and on the Drawings are to the center of the device.
5. Review the Contract Drawings for areas of sheeting and excavation specified under other sections of the Contract. Contractor shall schedule his work on underground piping and valves in these areas to run concurrently with that of the site work.
6. The Contractor shall be responsible for excavation, backfilling, bedding, curbing removal and replacement, concrete encasement, and surface restoration, including pavement for underground piping, valve installation and other work related to this Contract that disturbs existing conditions, equipment, improvements and facilities. Truck vehicle access (H-20 loading) shall be maintained on facility roads during construction.

D. Related Work Specified Elsewhere:

1. Division 1, Special Conditions.
2. Division 2, Sitework.
3. Division 3, Concrete.
4. Division 5, Metals.
5. Division 9, Finishes for field painting.
6. Division 11, Equipment
7. Division 13, Special Construction
8. Division 15, Mechanical

E. Work Included But Specified Elsewhere:

1. All site work required for the construction of the underground structures and pavement restoration shall conform to the requirements of Division 2, Sitework.
2. Concrete work for thrust blocks and pipe supports shall conform to the requirements of Division 3, Concrete.
3. Anchor bolts and other fasteners shall conform to requirements of Division 5, Metals.
4. Shop painting and surface preparation shall conform to requirements of Division 9, Finishes.

F. Temporary Power: Temporary light and power for construction purposes shall be provided in accordance with Division 1, Special Conditions.

1.2 QUALITY ASSURANCE

A. Reference Standards: Plumbing material and equipment shall conform in all respects to the latest approved standards of the following:

1. American Society for Testing and Materials (ASTM).
2. The American National Standards Institute (ANSI).
3. American Water Works Association (AWWA).
4. Occupational Safety and Health Code (OSHA).
5. Nassau County Department of Health (NCDH).

1.3 SUBMITTALS

A. General: Conform to requirements of the General Specifications and Special Conditions.

B. Shop drawings shall include the following information to the extent applicable to the particular item:

1. Manufacturer's name and product designation or catalog number.

2. Pressure ratings.
3. Conformance to applicable standards or specifications of ANSI, ASTM, AWWA, NFPA, OSHA, UL, or other organizations.
4. Dimensioned plan, section, and elevations showing means for mounting, piping connection and valves.
5. Materials and finish specification, including paints.
6. List of components including manufacturer's names and catalog numbers.
7. Manufacturer's instructions and recommendations for installation, operation, and maintenance.
8. Manufacturer's recommended list of spare parts.

1.4 PROJECT CLOSE-OUT

- A. Operation and Maintenance Data: Conform to requirements of Division 1 and the General and Special Conditions.

1.5 PRODUCT DELIVERY

- A. Delivery of Materials: Contractor shall instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.
- B. Storage: Plumbing equipment and material shall be stored and protected in accordance with Division 1 and General and Special Conditions.

1.6 IDENTIFICATION OF EQUIPMENT

- A. All plumbing items shall be identified. Identification shall be in addition to the manufacturer's nameplates and shall serve to identify the items function and the equipment or system which it serves.
- B. All new equipment shall be identified by means of laminated phenolic nameplates incised to show 1-inch high, white letters on a black background. Labels shall be fastened by means of 3/16-inch diameter, round-head, stainless steel, self-tapping screws. Equipment whose

designation has been changed shall be relabeled accordingly.

1.7 PROCEDURES FOR INSTALLATION

- A. The Contractor is cautioned to perform his work with due regard to safety and in a manner that will not interfere with the existing equipment or in any way cause interruption of any of the functions of the facility.
- B. Work shall be carried out without disruption to facility operations.
- C. No existing equipment or piping shall be removed without the specific direction and approval of the Owner, and without clearance by appropriate representatives of the Owner. Whenever such work is contemplated, the Contractor shall submit to the Owner a written request for scheduling such work. Written request must be received 5 working days prior to the date on which the proposed work is to be performed.

1.8 MAINTENANCE OF OPERATION

- A. During construction, the Contractor shall take steps to assure that water distribution and storm water disposal within the facility is not disrupted.
- B. Refer to Specification Section 01010 for Maintenance of Operation requirements and suggested sequence of construction.
- C. The Contractor shall furnish written notice to the Engineer and Owner 5 working days prior to performing the work that requires a disruption of water service. The written notice shall contain a schedule of proposed work.

+ + END OF SECTION + +

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SECTION 18002

NATURAL GAS SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials and incidentals required to provide new natural gas service as shown and specified.
2. Contractor shall pay all utility charges for this work.

B. Coordination:

1. Coordinate with National Grid to establish location and requirements for the new gas service. National Grid representative is Mr. Chet Singh (516-545-3876).

C. Related Work Specified Elsewhere:

1. Section 18500, Gas Fired Unit Heaters and Appurtenances
2. Section 18061, Steel Pipe.
3. Section 18088, Small Diameter Piping, Valves and Specials.

1.2 QUALITY ASSURANCE

A. Reference Standards

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval copies of manufacturers technical information, including the following:

1. Site plan locating, metering and related piping.

2. Copies of all utility correspondence.

1.4 COORDINATION

- A. The Plumbing Contractor shall furnish all labor, material and equipment to provide a gas line from the gas meter at each building to each gas unit heater.
- B. The Plumbing Contractor shall coordinate the installation with National Grid. The National Grid representative is Mr. Chet Singh (telephone number: 516-545-3876).
- C. All gas piping shall be installed and tested in accordance with National Grid gas requirements.
- D. The Plumbing Contractor shall be responsible for all National Grid charges and fees associated with this work.

PART 2 - PRODUCTS

2.1 NATURAL GAS EQUIPMENT

- A. Utility Metering: National Grid approved metering shall be furnished and installed as shown on the Drawings.

2.2 PIPING

- A. Use types of pipe and fittings as specified below unless otherwise specified or shown.
- B. All interior exposed gas piping shall be schedule 80 black steel. Exterior exposed gas piping shall be schedule 80 galvanized steel. Buried gas piping shall be black polyethylene for gas pressure service. All piping shall meet National Grid requirements.
- C. Support piping such that no strains are imposed on heaters, controls, or any other equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Natural Gas Service

1. Contractor shall coordinate with National Grid to provide a natural gas service to each structure indicated on the Contract Drawings and listed below:
 - a. Well House 7A and 8A
 - b. Packed Tower Aeration Building
 2. The Contractor shall provide and install all natural gas piping and appurtenances not to be provided and installed by National Grid.
- B. The gas supply line to each heater shall be furnished with a manual shutoff valve, and a 1/8-inch NPT plugged capping accessible for test gage connection.

3.2 ADJUSTMENT

- A. Check piping connections to unit heater. The gas piping system shall be checked for leaks after installation. Use a soap solution.

3.3 TESTING

- A. Piping tests shall be in accordance with the specifications.

3.4 IDENTIFICATION

- A. Piping shall be identified in accordance with Division 18 of this specification.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18051

BURIED PIPING INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish, install and test all buried piping, fittings, specials and appurtenances. The Work includes, but is not limited to, the following:
 - a. All types and sizes of buried piping, except as specified under other Sections. These include, but are not limited to: ductile iron, carbon steel, copper, and thermoplastic.
 - b. Supports, restraints, and thrust blocks.
 - c. Testing.
 - d. Cleaning and disinfecting.
 - e. Also included are installation of all jointing and gasketing materials, specials, couplings, flexible couplings, sleeves, tie rods, corrosion protection, and all other Work required to complete buried piping installation.
 - f. All valves, specials, sleeves and wall pipes shown or specified shall be incorporated into the piping system as required and as specified in the appropriate section of Division 18.
 - g. Unless otherwise shown or specified, buried piping installation includes all buried piping Work required, beginning at the outside face of structure or building foundation.

2. Piping less than 4-inch in diameter is specified in Section 18068 but shall conform to applicable requirements of Section 18051.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work that is related to this Section, including concrete, valves, ventilation and electrical.
2. Section 18051 specifies the installation of all buried piping materials specified in Division 18. Coordinate with these Sections.

C. Related Work Specified Elsewhere:

1. Section 02200 Earthwork.
2. Section 03300, Cast-In-Place Concrete.
3. Section 09900, Painting. (Surface preparation and shop priming are under specific piping sections.)
4. Division 18, Sections on Piping, Valves and Appurtenances.
5. All piping specifically included with equipment.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable requirements of UL and other authorities having jurisdiction.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 1. ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.
 2. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

3. AWWA C600, Installation of Ductile-Iron Water Mains and Appurtenances.
4. AWWA M23, PVC Piping.
5. ANSI B31.2, Fuel Gas Piping.
6. NFPA 54, National Fuel Gas Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 1. Laying schedules and detailed drawings in plan and profile for all piping.
 2. Full details of piping, valves, specials, joints, harnessing and connections to pipes and structures.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test results.
- C. Certificate: Submit certificate of compliance with referenced standards.
- D. Record Drawings: Submit in accordance with the requirements of Section 01720, Project Record Documents.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off delivery vehicle. Do not otherwise drop, roll or skid pipe. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.
- B. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.
- C. Pipe, fittings and specials shall be unloaded and stored in areas designated on the drawings. Interiors shall be kept completely free from dirt and foreign matter.
- D. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe bedding and backfill in accordance with Section 02200 Earthwork.
- B. Pipe materials required are listed in the Piping Schedules. Refer to applicable Sections for detailed materials Specifications.
- C. General:
 - 1. Pipe Marking:
 - a. Each piece of pipe or fitting shall be clearly marked with a designation which shall conform with designations shown on the Shop Drawings.
 - b. Class designation shall be cast or painted on each piece of pipe or fitting 4 inches in diameter and larger.
 - c. Piping smaller than 4 inches in diameter shall be clearly marked by manufacturer as to material, type and rating.

2.2 PIPING SCHEDULE

- A. Attached at the end of this Division is the "Piping Schedule." Conform to requirements of the schedule, unless otherwise specified or approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. All piping shall be sloped to avoid high spots and low spots and to facilitate drainage.

2. Proper and suitable tools and appliances for the safe, convenient handling and laying of pipe shall be used.
3. Install piping as shown on the Contract Drawings, specified and as recommended by the manufacturer.
4. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Drawings or Specifications.
5. Pipe, fittings and accessories that are cracked, damaged or in poor condition or with damaged linings will be rejected. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the contractor at his expense.
6. Minimum cover over buried piping shall be 4 feet unless otherwise shown or approved by Engineer.
7. Earthwork required is specified in Section 02200.

B. Bedding Pipe:

1. Bed pipe with materials as specified below and as shown on the Contract Drawings.
 - a. Trenches shall not be excavated below the pipe bottom. All loose and unsuitable material shall be removed from the trench bottom and backfilled with compacted select fill.
 - b. Pipe embedment material shall be sand placed in accordance with the requirements of Section 02200, Earthwork, within the following limits:
 - 1) From the bottom of the pipe to 12 inches above the crown of the pipe for all pipe sizes.
 - c. Pipe embedment shall be placed in maximum 6-inch layers and compacted for the full width of the trench. Recesses in the

embedment shall be provided around each joint to allow space for making joints and inspection.

2. Carefully and thoroughly compact all pipe bedding and fill.
3. No piping shall be laid until Engineer approves the bedding condition.
4. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

C. Laying Pipe:

1. Conform to manufacturer's instructions and to AWWA C600, and AWWA M23 where applicable.
2. Install unless otherwise approved by Engineer. Remove all pipe accurately to line and grade shown and relay pipes that are not laid correctly.
3. Slope piping uniformly between elevations given.
4. Ensure that water level in trench is at least 6 inches below bottom of pipe. Do not lay pipe in water. Maintain dry trench until jointing and backfilling are complete.
5. Start laying pipe at lowest point and proceed towards the higher elevations, unless otherwise approved by Engineer.
6. Place bell and spigot pipe so that bells face upstream unless otherwise approved by Engineer.
7. Excavate around joints in bedding and lay pipe so that only the barrel receives bearing pressure from the trench bottom.
8. Permissible deflections at joints shall not exceed 75 percent of the amount allowed by manufacturer and in no case exceed AWWA standards.
9. Prior to laying pipe, every precaution shall be taken to ensure that no foreign material enters the piping.

10. All pipe and fittings shall be carefully examined for cracks, damage or other defects while suspended above the trench, before installation. Defective materials shall be immediately removed from site.
11. Interior of all pipe and fittings shall be inspected and all dirt, gravel, sand, debris or other foreign material shall be completely removed from pipe interior before it is moved into the trench. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.
12. Every time that pipe laying is not actively in progress the open ends of pipe shall be closed by a watertight plug.
13. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.
14. Blocking under piping shall not be permitted unless specifically excepted by Engineer for special conditions. If permitted, conform to requirements of AWWA C600.
15. Repair protective coatings and linings in a satisfactory manner prior to backfilling. Refer to specific pipe specifications for coating systems required.

D. Jointing Pipe:

1. Clean completely all jointing surfaces and adjacent areas immediately before making joint.
2. Lubricate and adjust gaskets and "O"-rings as recommended by manufacturer.
3. After "O"-rings are compressed and before pipe is brought fully home, each gasket shall be carefully checked for proper position around full circumference of the joint.

4. Conform to AWWA C111 and to all applicable manufacturers recommendations pertaining to jointing pipe.
5. For mechanical joints the plain end shall be centered and pushed into the bell and the gasket shall be firmly pressed evenly into the bell. The gland shall be slid to the bell for bolting. All bolts with oiled threads shall be alternately torque tightened 180 degrees opposite to each other to seat the gasket evenly. The maximum torque shall be as follows:

<u>Bolt Size (inches)</u>	<u>Applied Torque (ft-lbs)</u>
5/8	50
3/4	80
1	90
1 1/4	150

All bolts and nuts shall be heavily coated with an approved bituminous or epoxy coating.

6. Solder Joints:
 - a. Ream or file pipe to remove burrs.
 - b. Clean and polish contact surfaces of joints.
 - c. Apply flux to both male and female ends.
 - d. Insert end of tube into fittings full depth of socket.
 - e. Heat joint evenly.
 - f. Apply continuous solder bead around entire circumference of joint.
7. Use hexagon head nuts and bolts on all flanged joints. Bolts shall neither project more than 1/4-inch from, nor fall short of the end of the nut.
8. Use ring gaskets unless otherwise specified or approved by Engineer. Maximum gasket thickness shall not exceed 1/8 inch. Gaskets shall be

suitable for service intended in accordance with manufacturers ratings and instructions.

9. Clean and lubricate bolt threads and gasket faces for flanged joints.
10. All bolts and nuts for underground service on valves, mechanical joint fittings, pipe joint and other ferrous metal appurtenances shall be packed in an asphaltic material. After the joint has been made and the bolts drawn to the proper tension, the joint, including glands, flanges, bolt heads and nuts shall be packed to a minimum thickness of one inch over all surfaces with Talcote, or other equal asphaltic material. Alternatively coat all joint areas and fasteners with two heavy coats of coal tar epoxy.

E. Concrete Trust Blocks:

1. Provide concrete trust blocks as shown, required, or otherwise approved by Engineer.

F. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

G. Closures:

1. Provide all closure pieces shown or required to complete the Work.
2. Locate closures in straight runs of pipe.

H. Backfilling:

1. Conform to applicable requirements of Section 02200 - Earthwork.
2. Backfill by hand until pipe is covered by at least 1 foot of fill.

3.2 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown shall be considered approximate.
2. Contractor is responsible for determining exact location of existing piping to which he must make connections, or which he may disturb during earth moving operations, or which may be affected by his work in any way.

B. Work on Existing Pipelines:

1. Do not take pipelines out of service except where specified or approved by Engineer.
2. Cut or tap pipes as shown or required with machines specifically designed for this work.
3. Install temporary plugs to keep out all mud, dirt, water and debris.
4. Provide all necessary adapters, fittings, pipe and appurtenances required.
5. Refer to Section 02200, Earthwork for additional requirements.
6. The Contractor shall provide a temporary thrust restraint system for existing pipes wherever the installation of new pipes disturbs the existing pipe's thrust restraint. Upon completion of new pipe installation, the Contractor shall restore the existing pipe thrust restraint system to its condition at the onset of the job.

3.3 TESTING OF PIPING

A. General:

1. Test all piping as specified below except as otherwise authorized by Engineer.
2. Notify Engineer 48 hours in advance of testing

3. Provide all testing apparatus, including pumps, hoses, gages, and fittings.
4. Unless otherwise noted, pipelines shall hold the specified test pressure for a period of 2 hours.
5. Pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.
6. Test pressures required are at the lowest elevation of the pipeline section being tested unless otherwise specified.
7. All gas piping shall be tested in accordance with NFPA 54.
8. Unless otherwise approved, conduct all tests in the presence of the Engineer.
9. All pipe shall be tested between valves.

B. Schedule of Pipeline Tests:

1. For pressure test values see "Piping Schedule."
2. Piping not on the schedule shall be tested at 1.5 times the maximum working pressure or 10 psi, whichever is greater.

C. Pressure Test Procedure (Except for Fuel Oil Piping and Gravity Sewer Pipe):

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by Engineer. Backfill and compact around all blocking before testing and as required to assure restraint by harnessed joints.
2. Allow concrete for blocking to reach design strength before testing.
3. Fill section to be tested slowly with water and expel all air. Install corporation cocks, if necessary, to remove all air.
4. Test only one section of pipe at a time.

5. Maintain the test pressure for at least 2 hours.
6. Allowable Leakage Rates (in gallons per hour per 1,000 feet per inch diameter) except as otherwise noted:
 - a. Buried Ductile iron and PVC - as specified herein and as specified in AWWA C.600 - Section 4 - Hydrostatic Testing.

<u>Nominal Pipe Diameter (inch)</u>	<u>Allowable Leakage Rate Per 1000 ft of Pipeline (gph)</u>
4	0.34
6	0.50
8	0.67
10	0.84
12	0.01

- b. Exposed Ductile iron and PVC and pipe in tunnels: No leakage.
 - c. Copper, steel and Thermoplastic: No leakage.
 - d. Sodium hypochlorite and caustic Solution: No leakage.
7. All visible leaks shall be made tight regardless of the amount of leakage or results of the leakage tests. If the pipes tested do not meet the leakage requirements of the leakage tests, they shall be repaired and retested as necessary until the leakage requirement is met.
8. All Work found defective shall be repaired or replaced at the expense of the Contractor.

D. Test Procedure for Gravity Sewer Piping:

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by the Engineer.
2. After pipe trenches have been satisfactorily backfilled to the required depth, piping shall be checked by the Engineer to determine if any

displacement of pipe has occurred. A bright light shall be flashed between manholes. If the illuminated interior of the pipe shows displaced pipe, improper alignment or any other defects, the defect shall be corrected as determined by the Engineer. Upon satisfactory completion of the displacement test, the pipe shall be tested for leakage.

3. The Contractor shall test each section of gravity sewer pipe between manholes for watertightness individually. No continuous sections shall be tested simultaneously.
4. The Contractor shall plug the downstream end of the pipeline under test and all outlets discharging into the upstream manhole.
5. The upstream manhole and the section of pipeline under test shall be filled by the Contractor with water. The elevations to which the manholes shall be filled is a minimum of 2 feet above the crown of the pipe, or at least 2 feet above existing groundwater, whichever is higher.
6. The pipe shall remain filled for an initial 1 hour period to allow for stabilization. Following the stabilization period, water shall be added to the required elevation.
7. Leakage loss shall be measured over a period of 4 hours. After the stabilization period, the Engineer will take 3 readings of the water level in the manhole, and 4 hours later, take 3 more readings. An average of the readings will be used by the Engineer to calculate leakage.
8. If the measured rate of leakage is less than or equal to the allowable leakage rate, the section of pipeline tested is acceptable. If the test fails, the section of pipe must be repaired or replaced at the expense of the Contractor, and retested by the same procedures. Regardless of the results of the leakage test, all visible leaks shall be repaired.
9. The maximum allowable leakage rate for any section of pipeline under testing shall not exceed 200

gallons per inch of internal diameter per mile of pipe per day.

10. At the conclusion of the test, clean all pipelines by flushing with water or other means, and remove any debris which may have entered the pipeline during construction.

3.4 CLEANING AND DISINFECTION

A. All piping shall be thoroughly cleaned and flushed prior to placing in service in a manner approved by Engineer.

B. Disinfection:

1. Disinfect all potable water piping wherever installed or relocated.
2. Completely clean interior of all piping and flush piping smaller than 12 inches prior to disinfection with water at a minimum velocity of 2 1/2 feet per second.
3. Conform to procedures described in AWWA C651 except that the tablet method will not be permitted unless otherwise approved by the Engineer.
4. Water for flushing, testing and chlorination shall be furnished by the Contractor.
5. Chlorine shall be supplied by Contractor.
6. Bacteriologic tests shall be performed by Contractor. A certified test laboratory report shall be submitted for approval by the Engineer.
7. Chlorine concentration in the water entering the piping shall be between 50 and 100 parts per million, such that a minimum residual concentration of 25 parts per million will be left after a 24-hour retention period. The operation shall be repeated as necessary to provide complete disinfection.

+ + END OF SECTION + +

SECTION 18052

EXPOSED PIPING INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish and install and test all exposed piping, fittings, specials, and appurtenances. The Work includes, but is not limited to the following:
 - a. All types and sizes of exposed piping, except as specified under other Sections. These include, but are not limited to ductile iron, carbon steel, stainless steel, thermoplastic and copper.
 - b. Piping embedded in concrete within a structure or foundation will be considered as exposed and included herein.
 - c. Supports, restraints, and thrust blocks.
 - d. Testing.
 - e. Cleaning and disinfecting.
 - f. Installation of all joints, specials, couplings, flexible couplings, flanged adapters, expansion joints, sleeves, tie rods, jointing and gasketing materials and all other Work required to complete installation of exposed piping.
 - g. All valves, specials, sleeves, wall pipes and floor pipes shown or specified shall be incorporated into the piping system as required and as specified in the appropriate sections of Division 18.

2. Piping less than 4-inches in diameter is specified in Section 18068 but shall conform to applicable requirements of Section 18052.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section, including concrete, valves, electric, and ventilation.
2. Section 18052 specifies the installation of all exposed piping.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 09900, Painting. (For shop surface preparation and priming refer to specific piping sections.)
3. Division 18, Sections on Piping, Valves and Appurtenances.
4. All piping specifically included with equipment.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable requirements of UL and other authorities having jurisdiction.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ANSI B16.3, Malleable Iron Screwed Fittings.
 2. ANSI B16.4, Cast Iron Screwed Fittings.
 3. ANSI B16.5, Steel Pipe Flanges, Flanged valves and Fittings.
 4. ANSI B16.9, Factory-Made Wrought Steel Buttwelded Fittings.

5. ANSI B16.11, Forged Steel Fittings, Socket-Welding and Threading.
6. ANSI B31.1, Power Piping.
7. ANSI B31.2, Fuel Gas Piping.
8. ANSI B31.8, Gas Piping Systems.
9. ANSI D1.1, Structural Welding Code.
10. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
11. AWWA C206, Field Welding of Steel Water Pipe.
12. AWWA C600, Installation of Ductile-Iron Water Mains and Appurtenances.
13. AWWA C601, Disinfecting Water Mains.
14. AWWA C651, Disinfecting Water Mains.
15. AWWA M23, PVC Piping.
16. NFPA 54, National Fuel Gas Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 1. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various piping components and accessories. The illustrations shall be of sufficient detail to serve as a guide for assembly and disassembly.
 2. Complete layout and installation drawings with clearly marked dimensions. Piece numbers which are coordinated with the tabulated pipe layout schedule shall be clearly marked. Piping layout drawings shall indicate the following information on pipe supports: location, support type, hanger rod size, insert type and the load in pounds.

3. Weight of all component parts.
 4. Design calculations where specified.
 5. Tabulated pipe layout schedule shall include the following information for all pipe and fittings: service, pipe size, working pressure, wall thickness, piece number and laying length.
 6. Interfacing of piping system to equipment and appurtenances.
 7. Full details of piping, fittings, specials and connections to equipment in plan and section.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.
- C. Certificates: Submit certificates of compliance with referenced standards.
- D. Record Drawings: Submit in accordance with the requirements of Section 01720, Project Record Documents.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid pipe. Materials that are cracked, chipped, gouged, dented or otherwise damaged will not be approved.
- B. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.
- C. Pipe, fittings and specials shall be unloaded as close to the place where they are to be laid as is practical, at a location which has been approved by the Engineer. Interiors shall be kept completely free from dirt and foreign matter.
- D. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe materials required are listed in the Piping Schedules at the end of this section. The applicable Sections of Division 18 for detailed material Specifications apply.
- B. Pipe Marking:
 - 1. Class designation shall be cast or factory painted on each piece of pipe and fitting 3 inches in size and larger.
 - 2. Each piece of pipe and fitting shall be clearly marked with a designation which shall conform with designations shown on the Shop Drawings.
- C. Pipe Identification Markers and Arrows: Refer to Section 09900, Painting.

2.2 EXPOSED PIPING SCHEDULE

- A. Attached to the end of this Division is the "Exposed Piping Schedule." Conform to the requirements of the schedule, unless otherwise specified or approved by Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Install piping as shown on the Contract Drawings, specified and as recommended by the manufacturer.
 - 2. All pipes shall be sloped to avoid high spots and low spots and to facilitate drainage.
 - 3. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Drawings or Specifications.

4. Pipe, fittings and accessories that are cracked, damaged or in poor condition or with damaged linings will be rejected.
5. For specially fabricated piping Subcontractor shall provide the services of a competent manufacturer's installation specialist when pipe installation begins, unless otherwise approved by Engineer.
6. Conflicts between piping systems and equipment or structures shall be presented to Engineer for determination of corrective measures before proceeding.
7. Install a flange or union at all equipment connections and valves.

B. Piping:

1. Install straight runs true to line and elevation.
2. Install vertical pipe truly plumb in all directions.
3. Install piping parallel or perpendicular to building walls. Piping at angles and 45 degree runs across corners will not be accepted unless specifically shown or approved.
4. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, etc.
5. Install piping so as to leave all corridors, walkways, work areas, and like spaces unobstructed. Unless otherwise approved provide a minimum headroom clearance under all piping of 6 feet 6 inches.
6. Provide temporary caps or plugs over all pipe openings at the end of each days work and when otherwise required or directed by Engineer.
7. Cutting: Cut pipe from measurements taken at site, not from Drawings.

8. Provide flanges for connection to pumps, valves and other flanged equipment.

C. Joints:

1. General:

- a. Make joints in accordance with Piping Schedule and the pipe manufacturer's recommendations and the requirements below.
- b. Cut piping accurately and squarely and install without forcing or springing.
- c. Ream out all pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
- d. Remove all cuttings and foreign matter from the inside of pipes and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is installed.

2. Threaded Joints: Use standard, right-hand tapered full depth threads on steel piping and apply an approved joint compound to the male threads only, before installation. Leave not more than three pipe threads exposed at each connection.

3. Solder Joints:

- a. Ream or file pipe to remove burrs.
- b. Clean and polish contact surfaces of joints.
- c. Apply flux to both male and female ends.
- d. Insert end of tube into fittings full depth of socket.
- e. Heat joint evenly.

f. Form continuous solder bead around entire circumference of joint.

4. Flanged Joints: Assemble flanged joints with approved full-face gaskets and gasket compounds and draw up flange bolts evenly.
5. Plastic Pipe Joints: Make joints in plastic piping in accordance with the manufacturer's recommendations.
6. Use hexagon head nuts and bolts on all flanged joints. Use 1/8 inch thick full face gaskets unless otherwise approved by Engineer. Gaskets shall be suitable for service intended in accordance with manufacturer's ratings and instructions.

D. Unions:

1. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
2. Provide a union downstream of each valve with screwed connections.
3. Provide screwed, flanged unions or flanged adapters at each piece of equipment, where shown, and where necessary to install or dismantle piping.

E. Eccentric Reducers: Use eccentric reducers where shown and where air or water pockets would otherwise occur in mains because of a reduction in pipe size.

F. Valves and Accessories:

1. Provide supports for large valves, and other heavy items.
2. Position valve operators as shown. When the position is not shown, install the valve so that it can be conveniently operated and as approved by Engineer. Avoid placing operators at angles to the floors or walls.

G. Wall Sleeves:

1. Provide sleeves wherever pipes pass through walls, partitions, floors and roofs unless otherwise shown. Sleeves through wall shall be flush with wall face. Sleeves shall be as specified in Section 18096.
2. Anchor sleeves to concrete walls and structural steel as shown or otherwise approved.
3. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
4. Do not install sleeves and pipes through structural members unless specifically shown and approved by Engineer.

H. Transitions from One Type of Pipe to Another: Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

I. Additional Requirements for Copper Tubing:

1. Joints shall be made with clean bright ends, properly fluxed, using 95 percent tin, 5 percent antimony solder. Solder containing lead will not be allowed.
2. Runs shall contain unions at connections to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.
3. All horizontal lines shall be pitched to facilitate draining. Unless otherwise shown and/or specified, all pipe runs shall be tapped at low points and fitted with minimum 1/2" NPT plugs. Drain lines shall not have a pitch less than 1/8-inch per foot.

J. Additional Requirements for Thermoplastic Piping:

1. All valves shall be supported independently of the piping system.

2. Wide band supports as recommended by manufacturer and approved by Engineer shall be used to minimize localized stresses. Inert plastic shields shall be placed where plastic piping makes contact with steel and/or concrete.
3. Piping passing through walls shall be provided with a sleeve of wearing material to prevent abrasion damage to piping.
4. When anchors are required at locations other than equipment they shall be placed at elbows, valve locations and at bends in pipe line.
5. Spacing of supports shall be in accordance with the manufacturers published values at the maximum design operating temperature of the pipe, but in no case shall exceed 6 feet on center.
6. Use "U" clamps with wide band inert plastic circumferential contact. Avoid all pressure contact with piping.
7. On long runs of piping use guides to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by manufacturer.
8. Use expansion joints to take up pipe expansion. Provide anchors to restrain the expansion joint. Use of the expansion joints shall be kept to a minimum. Flexible connectors may be used to absorb thermal movement when approved by Engineer.
9. Do not install pipe when temperature is less than 60°F except as otherwise recommended by manufacturer and approved by Engineer.

K. Restraints, Supports and Thrust Blocks:

1. Install restrained joints as specified.
2. Provide concrete thrust blocks as shown or otherwise approved by Engineer.

3.2 TESTING OF PRESSURE PIPING

A. General:

1. Test all piping as specified below unless otherwise authorized by Engineer.
2. Notify Engineer 48 hours in advance of testing.
3. Provide all testing apparatus including pumps, hoses, gages, and fittings.
4. Pipelines shall hold the specified test pressure for a period of two hours.
5. Pipelines which fail to hold specified test pressures or which exceed the allowable leakage rate shall be repaired and retested.
6. Test pressures required are at the lowest elevation of the pipeline section being tested, unless otherwise specified.
7. Unless otherwise approved, conduct all tests in the presence of the Engineer.

B. Schedule of Pipeline Tests:

1. For pressure test values see "Exposed Piping Schedule" at the end of this Division.
2. Piping not in Schedule shall be tested at 1.5 times the maximum working pressure or 30 psi, whichever is greater.

C. Hydrostatic Pressure and Leakage Test Procedure:

1. Insure that all supports and restraint protection are securely in place.
2. Fill section to be tested slowly with water and expel all air. Install cocks, if necessary, to ensure removal of air.
3. Test only one section of pipe at a time.

4. Apply test pressure required for two hours and observe pressure gage. Check carefully for leaks while test pressure is being maintained.
5. Thermoplastic piping shall be tested with water and after the test, the water shall be removed.
6. Allowable Leakage Rates. No leakage permitted on any exposed pipe and no leakage permitted on any sodium hypochlorite piping (buried or exposed).

3.3 CLEANING AND DISINFECTION

- A. All piping shall be thoroughly cleaned and flushed prior to placing in service in a manner approved by Engineer.
- B. Disinfection:
 1. Disinfect all potable water piping wherever installed or relocated.
 2. Completely clean interior of all piping and flush piping smaller than 12 inches prior to disinfection with water at a minimum velocity of 2 1/2 feet per second.
 3. Conform to procedures described in AWWA C651 and any additional requirements prescribed by the public health authorities having jurisdiction, unless otherwise approved by the Engineer.
 4. Water for flushing, testing and chlorination is available on-site.
 5. Chlorine shall be supplied by the Contractor.
 6. Bacteriologic tests shall be performed by Contractor. A certified test laboratory report shall be submitted for approval by the Engineer.
 7. Chlorine concentration in the water entering the piping shall be between 50 and 100 parts per million, such that a minimum residual concentration of 25 parts per million will be left after a 24-hour retention period. The operation shall be repeated as necessary to provide complete disinfection.

3.4 SURFACE PREPARATION AND PAINTING

- A. Refer to specific pipe specifications for painting systems required.
- B. Piping that is field prepared and painted shall conform to the requirements of Section 09900, Painting.

+ + END OF SECTION + +

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SECTION 18053

DUCTILE IRON PIPE, FITTINGS AND SPECIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish and install ductile iron pipe, fittings and specials necessary to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 09900, Painting.
2. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Obtain pipe and fittings from one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110 (ANSI A21.10), Gray-Iron and, Ductile-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
3. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
4. AWWA C115 (ANSI A21.15), Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges.

5. AWWA C150 (ANSI A21.50), Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 (ANSI A21.51), Ductile Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
7. ANSI B18.2.1, Square and Hex Bolts and Screws.
8. ANSI B18.2.2, Square and Hex Nuts.
9. ASTM A 307, Carbon Steel Externally Threaded Standard Fasteners.
10. ASTM A 354, Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.
2. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.
3. Submit this data with shop drawings required under Section 18051 and 18052.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.

C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Sections 18051 and 18052.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: All exposed interior and exterior ductile iron pipe shall be flanged and all exterior buried ductile iron pipe shall be mechanical joint (M.J.) unless otherwise shown on the drawings, specified herein, or directed by the Engineer.
- B. Ductile Iron Pipe and Fittings:
 - 1. Pipe:
 - a. Flanged Pipe: Fabricate in accordance with requirements of AWWA C115:
 - 1) Thickness: Flanged ductile iron pipe shall be minimum Class 53, unless otherwise specified.
 - b. M.J. Pipe: Fabricate in accordance with requirements of AWWA C151:
 - 1) Thickness: M.J. ductile iron pipe and fittings shall be minimum Class 52, unless otherwise specified.
 - 2. Joints:
 - a. Flanged Joints: Conform to AWWA C110 capable of meeting working and test pressure specified in Section 18051 and 18052:
 - 1) Gaskets: Cloth-inserted rubber, 1/8-inch thick, full face. Gaskets shall be suitable for the service intended.
 - 2) Bolts and Nuts: Conform to ANSI B18.2.1 and ANSI B18.2.2, respectively. Exposed bolts and nuts shall be ASTM A 307, Grade B. Submerged and exterior exposed bolts and nuts shall be Type 304 stainless steel.

b. Mechanical Joints: Conform to AWWA C111:

- 1) Gaskets: Plain tip.
- 2) Bolts and Nuts: High strength, low alloy steel.
- 3) Glands: Restrained Ductile Iron Retainer Gland.

c. Push-On Joints: Conform to AWWA C111:

- 1) Gaskets: Molded rubber.
- 2) Stripes: Each plain end shall be painted with a circular stripe such that it provides a guide for visual check to determine when the joint is properly assembled.

d. Restrained Joints:

- 1) Restrained joints for mechanical joint piping shall be:
 - a) Locked mechanical joint style F-127-D by Clow Cast Iron Pipe and Foundry Division of the Clow Corporation.
 - b) Lok-Fast Joint by American Cast Iron Pipe Company.
 - c) Mechanical joint with retainer glands with alloy steel set screws.
 - d) Or equal.
- 2) Restrained joints for push-on joint piping shall be:
 - a) Clow Super-Lock Joint Pipe Style P-128 by Clow Cast Iron Pipe and Foundry Division of the Clow Corporation.

b) Lok-Ring Joint by American Cast Iron Pipe Company.

c) Or equal.

3. Fittings: Conform to AWWA C110:

- a. Pressure Rating: 350 psi mechanical, 250 psi flanged.
- b. Material: Ductile iron.
- c. Gaskets: As specified above for joints.
- d. Bolts and Nuts: As specified above for joints.

4. Coatings and Linings:

- a. All ductile iron pipe and fittings, with the exception of sleeves shall be lined with a bituminous seal coated cement-mortar lining in accordance with AWWA C104. This lining shall be twice the standard thickness specified in AWWA C104.
- b. Buried pipe and fittings shall be coated on the outside with a bituminous coating, approximately 1-mil thick. Exposed pipe shall be prime coated.

C. Couplings:

- 1. Sleeve Type, Flexible Couplings shall only be used with the approval of the Engineer:
 - a. Pressure and Service: Same as connected piping.
 - b. Materials: Steel.
 - c. Gaskets: Suitable for service intended.
 - d. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 304 stainless steel bolts and nuts.

e. Harnessing:

- 1) Harness couplings as shown, specified or otherwise required to restrain all pressure piping.
- 2) Dimensions, sizes, spacing and materials for lugs, tie bolts, washers, and nuts shall conform to the standards of the manufacturer for the pipe size, wall thickness and working pressure required.
- 3) No less than two bolts shall be furnished for each coupling.
- 4) Adjacent flanges shall be tied with tie bolts. The bolts, washers and nuts shall conform to the standards of the manufacturer for pipe size and test pressure of the pipe.
- 5) Lugs and tie bolts shall be designed for 150 percent of the piping system test pressure specified herein.
- 6) Tie bolts, nuts and washers shall be ASTM A 193, Grade B7 steel or better.

f. Product and Manufacturer: Provide couplings as manufactured by one of the following:

- 1) Dresser Industries.
- 2) Rockwell International Corp.
- 3) Or equal.

2. Flanged Adapters:

- a. All flanged adapters, except as shown on the Drawings or directed by the Engineer, shall be as follows:
- b. Pressure and Service: Same as connected piping.

- c. Materials:
 - 1) Cast iron or ductile iron for pipes up to 12-inch diameter.
 - 2) Steel for pipes larger than 12-inch diameter.
 - d. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated.
 - e. Harnessing:
 - 1) Harness flanged adapters to restrain all pressure piping.
 - 2) Flanged coupling adapters for all pipe sizes shall be harnessed by tying the adapter to the nearest pipe joint flange using tie bolts as specified for flexible couplings.
 - f. Product and Manufacturer: Provide flanged adapters as manufactured by one of the following:
 - 1) Dresser Industries.
 - 2) Rockwell International Corporation.
 - 3) Or equal.
- D. Pipe Taps: Provide taps where shown or required for small pipe connections. Where pipe or fitting wall thickness is too small to provide required number of threads, a boss or pipe saddle shall be installed. Teflon tape or a commercial thread compound which is suitable to the service shall be used on threads.
- E. Tie Rods: Tie rods shall be as specified herein, as shown on the drawings, and as required by the Engineer. Tie rods shall be provided at all changes in pipe direction, horizontal or vertical, fittings, valves and at all points requiring resistance to pressure. Steel tie bolts shall be provided with all tie rods. Tie bolts shall be used in place of "T" bolts in mechanical joint connections, where required. The use of duc-lugs shall

not be permitted. Tie rods shall be furnished with nuts and washers. Tie rod, nuts, bolts and washers shall be coated with bitumastic after installation and testing.

2.2 IDENTIFICATION

A. All pipeline material shall be stamped, marked or identified with the following:

1. Name of manufacturer.
2. Pipe size.
3. Pipe material.
4. Wall thickness.
5. Rating.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall inspect all piping to ensure that piping is free from defects in material and workmanship. The compatibility of all pipe, fittings and coatings shall be verified.

3.2 INSTALLATION

- A. Refer to Sections 18051 and 18052 for piping installation, testing, cleaning and acceptance.
- B. All flanges shall be factory installed. Field installation of flanges on piping will not be accepted.

+ + END OF SECTION + +

SECTION 18061

STEEL PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall supply all labor, materials, equipment and incidentals required to install, test, and put in satisfactory service, steel pipe as shown on the Contract Drawings, as herein specified and required.
2. Extent of piping is shown on the Contract Drawings and in the Schedules at the end of Division 18.

B. Related Work Specified Elsewhere:

1. Section 09900, Painting.
2. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Obtain pipe and fittings from one manufacturer.

B. Requirements of Regulatory Agencies:

1. Building Codes: Comply with applicable requirements of all governing authorities and the following codes:
 - a. New York State Uniform Fire Prevention and Building Code.
 - b. NFPA 54, National Fuel Gas Code.
 - c. DOT, Department of Transportation (Formerly ICC).

- d. OSHA, Occupational Safety and Health Association.
 - e. Nassau County Fire Protection Ordinance, Ordinance 407, Article III.
 - f. Nassau County Public Health Ordinance on Toxic and Hazardous Materials Storage, Handling and Control Article XI.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
- 1. ASTM A53 Pipe steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 2. ASTM A105/A 105M Forgings, Carbon Steel, for Piping Components.
 - 3. AWWA C206, Field Welding of Steel Water Pipe.
 - 4. ANSI B16.5, Dimension standards for Steel Pipe Flanges and Flanged Fittings.
 - 5. ANSI-B16.11 Forged Steel Fittings Socket Weld, and Threaded.
 - 6. ASTM A 234 Piping Fitting and Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
 - 7. ANSI B 2.1, Pipe Threads.
 - 8. SSPC-SP6, Steel Structures Painting Counsel Standard for Commercial Blast Cleaning.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
- 1. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.

2. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.
 3. Submit this data with Shop Drawings required under Sections 18051 and 18052.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.
- C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Sections 18051 and 18052.

PART 2 - PRODUCTS

2.1 MATERIALS AND SERVICE CONDITIONS

- A. Steel pipe shall be ASTM A 53. Thickness class shall be Schedule 40 unless otherwise indicated.
- B. Material, manufacturing operations, testing, and inspection of pipe shall be in conformance with applicable portions of AWWA C200.
- C. All fittings shall have the same minimum wall thickness as the pipe.
- D. Unless otherwise specified, all steel pipe shall be furnished unlined and the interior of all unlined steel pipe shall be sand blasted according to SSPC-SP6 and immediately grease coated. The grease coating shall be maintained during construction and shall be washed clean with solvents just before being placed in service. Each piece of pipe and fitting must be completely cleaned before installation.
- E. Joints shall be provided at intervals so that piping, may be readily disassembled. In general, flanges shall be located at all valves and equipment and in piping runs so that individual sections of pipe may be readily removed if necessary. Submit details of all flanged joint locations to Engineer for approval.

- F. Threaded Joint: Steel pipe shall be furnished with threaded end and line couplings, unless otherwise shown or specified. Threads shall conform to ANSI B2.1, tapered threads 3/4-inch per foot.
- G. Fittings: All fittings shall be the smooth type. Unless otherwise shown or approved, fittings shall conform to ANSI B16.11/ANSI B16.9.

2.2 IDENTIFICATION

- A. All pipeline materials shall be stamped, marked or identified with the following:
 - 1. Name of manufacturer.
 - 2. Pipe size.
 - 3. Material.
 - 4. Wall thickness.
 - 5. Rating.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Contractor shall inspect all piping to ensure that piping is free of defects in material and workmanship. The compatibility of all pipe, fittings and coatings shall be verified.

3.2 INSTALLATION

- A. Refer to Sections 18051, 18052 and 18053 for piping installation, testing, cleaning and acceptance.

+ + END OF SECTION + +

SECTION 18064

THERMOPLASTIC PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to install and place in satisfactory service polyvinyl chloride (PVC) conveyance pipe, high density polyethylene (HDPE) corrugated drainage pipe, fittings and specials.
2. The extent of piping is shown on the Contract Drawings and in the schedules following Division 18.

B. Coordination: Review installation procedures under other Sections and Contracts and coordinate with the Work that is related to this Section.

C. Related Work Specified Elsewhere:

1. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Obtain each type of pipe and fittings from one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM D 1598, Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
2. ASTM D 1599, Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

3. ASTM D 1784, Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) PVC Compounds.
4. ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
5. ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings.
6. ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D 2564, Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
8. ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.
9. ASTM F 405, Standard Specification for Corrugated Polyethylene Pipe and Fittings.
10. ASTM F 667, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.
11. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
12. Standard No. 14, National Sanitation Foundation.
13. American National Standards Institute (ANSI).

C. Shop Tests: Piping manufacturer shall maintain a continuous quality control program. All PVC materials used to manufacture pipe and fittings under this Section shall be tested for conformance to the requirements of ASTM D 1784. Contractor shall furnish the Engineer with certified test results.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.

2. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.
 3. Submit this data with shop drawings required under Section 15051 and 15052.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.
- C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Refer to Sections 15051 and 15052.
- B. Storage: All Pipe materials shall be stored off the ground in an area approved by the engineer. Do not store pipe in sunlight.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. All pipe line materials shall be permanently marked with the following:
1. Name of manufacturer.
 2. Date of manufacture.
 3. Operating design pressure at operating design temperature.
 4. Mark number to match Shop Drawings.
 5. Type of pipe and nominal size.
 6. Manufacturer's part number.

2.2 PVC PRESSURE AND CONTAINMENT PIPE

A. PVC Pipe:

1. Unless otherwise shown or specified all pipe shall be PVC, Type 1, Grade 1, Schedule 80, conforming to ASTM D 1785. Rerun or reclaimed materials will not be acceptable.
2. Fittings: Solvent welded fittings shall conform to ASTM D 2467 for socket type.

B. Provide suitable sleeve-type expansion joints in exposed piping to permit 1-inch minimum expansion per 50 feet of continuous pipe length.

C. Workmanship: The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be uniform in color, opacity, density, and other physical properties.

D. Dimensions and Tolerances: Dimensions and tolerances shall be measured in accordance with ASTM D 2122. The eccentricity of the inside and outside circumferences of the pipe walls shall not exceed 12 percent. Where required, internal diameter of flange adapters shall be chamfered to provide adequate clearance for operation of adjacent butterfly valves.

E. Sustained Pressure: The pipe shall not fail, balloon, burst, or weep as defined in ASTM D 1598.

F. Burst Pressure: The minimum burst pressure shall be as given, when determined in accordance with ASTM D 1599.

G. Piping and fittings shall have ultraviolet inhibitor pigment to resist ultraviolet deterioration.

1. All valves shall be supported independently of the piping system.
2. Wide band supports as recommended by manufacturer and approved by Engineer shall be used to minimize localized stresses.

3. Use "U" clamps with wide band inert plastic circumferential contact. Avoid all pressure contact with piping.
4. Spacing of supports shall be in accordance with the manufacturers published values at the maximum design operating temperature of the pipe unless otherwise specified, shown or approved by Engineer.
5. On long runs of piping use guides to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by manufacturer.
6. Piping passing through walls shall be provided with a sleeve of wearing material to prevent abrasion damage to piping.
7. When anchors are required at locations other than equipment they shall be placed at elbows, valve locations and at bends in pipeline.
8. Use expansion joints to take up pipe expansion. Provide anchors to restrain the expansion joint. Use of expansion joints shall be kept to a minimum. Flexible connectors may be used to absorb thermal movement when approved by Engineer.
9. Do not install pipe when temperature is less than 60°F except as otherwise recommended by manufacturer and approved by Engineer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Contractor shall inspect all piping to ensure that piping is free of defects in material and workmanship. The compatibility of all pipe, fittings and coating shall be verified.

3.2 INSTALLATION

- A. General: Refer to Sections 18051 and 18052 for piping installation, testing, cleaning and acceptance.

+ + END OF SECTION + +

SECTION 18068

SMALL DIAMETER PIPING, VALVES AND SPECIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, tools, materials, and equipment necessary for providing piping, valves and specials less than 4-inches in diameter, unless otherwise noted.
2. Included are all pipe, valves, fittings, couplings, specials, jointing materials, bolts, nuts and gaskets, factory-applied painting and other appurtenances required for the installation, testing and cleaning of above piping.
3. It is the intention of the Drawings and of these Specifications to provide complete and workable piping systems. Any miscellaneous fittings and appurtenances required for proper completion of the Work shall be considered as having been included under this Section.
4. Piping specifically excluded from this Section is as follows:
 - a. All piping, valves and specials 4-inches in diameter and larger.
 - b. All pipe specifically included with equipment.

B. General:

1. All materials, equipment and appurtenances shall be new, clean and in accordance with material specifications. In no case will second-hand or damaged material be acceptable.
2. Piping shall be clearly marked by manufacturer as to material, type and rating.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting (refer to specific piping specifications for surface preparation and shop priming).
2. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

- A. Design Criteria: The design conditions are as described in this Section.
- B. Source Quality Control: All pipe and specials shall have the working pressure stenciled thereon. Pipe that has been designed for abnormal load conditions or thrust restraint shall have special markings thereon which can be readily identified.
- C. Reference Standards:
1. Comply with applicable provisions and recommendations of the following:
 - a. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
 - b. ANSI B16.22, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
 - c. ASTM A 307, Carbon Steel Externally Threaded Standard Fasteners.
 - d. FS 0-F-506, Flux, Soldering; Paste and Liquid.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
1. Illustrations, specifications and engineering data including: dimensions, materials, size, weight,

coatings and linings for all piping, valves and appurtenances.

2. Complete layout drawings including location of all valves, fittings, supports, and appurtenances. Type of joints, and restraints where provided, shall be clearly indicated.
 3. Interfacing of piping system to equipment and appurtenances.
 4. Full details of piping, fittings, specials and connections to existing pipes or equipment in both plan and profile.
 5. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.
 6. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.
 7. Submit this data with Shop Drawings required under Sections 18051 and 18052.
- B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.
- C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Sections 18051 and 18052.

PART 2 - PRODUCTS

2.1 COPPER TUBING

- A. Tubing:

1. Copper tubing shall be seamless tubing conforming to ASTM B 88.

2. Buried service tubing shall be Type K, soft.
3. Exposed copper tubing shall be Type L.
- B. Fittings: Fittings shall be wrought copper conforming to ANSI B16.22, except fittings for instrument air shall be compression type, Swagelok, or equal.
- C. Joints: Joints shall be sweat type, with solder 95 percent tin, 5 percent antimony and flux conforming to FS 0-F-506, Type 1, except joints for instrument air shall be compression type, Swagelok, or equal.
- D. Surface Preparation and Field Painting: All exposed copper piping shall be field painted in accordance with Section 09900, Painting.

2.2 DUCTILE IRON PIPE

- A. Conform to requirements of Section 18053.

2.3 STEEL PIPE

- A. Conform to Sections 18053 and 18061.

2.4 SPECIAL COUPLINGS

- A. Flexible Couplings:

1. Conform to requirements of Section 18053.

- B. Dielectric Pipe Couplings:

1. Dielectric pipe couplings shall be used wherever copper pipe connects to steel, or ductile iron pipe and appurtenances. Couplings shall have steel bodies with nonconducting bushings on both ends. Ends shall have standard pipe threads. Couplings shall be rated for at least 200 psi at 225°F.

2. Manufacturer:

- a. Thermodynamics Corporation.
- b. Water Vallet Company.
- c. Or equal.

2.5 FLEXIBLE PVC BRAIDED TRANSFER PIPING, HYPOCHLORATE/PHOSPHATE SERVICE

- A. Flexible PVC braided chemical transfer piping shall be provided to convey sodium hypochlorite solution or phosphate solution from the storage tank into the discharge main, as shown on the Contract Drawings.
- B. Tubing shall be flexible PVC with an integral braid. Diameter shall be as shown on the piping schedule. Tubing shall be NSF approved for potable water use. Maximum working pressure shall be 250 psi. Minimum bend radius of the tubing shall be 3 inches. All fittings shall be serrated nipples constructed of nylon and secured with stainless steel hose clamps.

2.6 FLEXIBLE PVC BRAIDED TRANSFER PIPING, LIME SLURRY SERVICE

- A. Lime slurry transfer piping shall be installed to convey the lime slurry into the discharge main. Transfer piping shall be 1-inch inside diameter flexible PVC with an integral braid. Tubing shall be NSF approved for potable water use. Maximum working pressure shall be 125 psi. Minimum bend radius of the tubing shall be 8 inches. All fittings shall be serrated nipples constructed of brass and secured with stainless steel hose clamps.

2.7 VALVES AND SPECIALS

A. General:

- 1. All valves shall have manufacturer's name and working pressure cast in raised letters on valve body.
- 2. All manual valve operators shall turn clockwise to close unless otherwise specified. Valves shall indicate the direction of operation.
- 3. Unless otherwise specified all flanged valves shall have ends conforming to ANSI B16.1, Class 125.
- 4. All buried valves shall be provided with adjustable two piece valve boxes and provided with extension stems, operating nuts and covers unless otherwise

shown or specified. Extension stems shall terminate 12 inches below finished grade. All buried valves shall be of nonrising stem.

5. All bolts, nuts and studs on or required to connect buried valves shall be of stainless steel.
6. All bolts and studs embedded in concrete and studs required for wall pipe shall be of stainless steel.
7. All other bolts, nuts and studs shall conform to ASTM A 307, Grade B; or ASTM A 354.
8. Bolts and nuts shall have hexagon heads and nuts.
9. Gasket material and installation shall conform to manufacturer's recommendations.
10. Whenever bronze body valves are connected to plastic piping, the end connection shall be screwed with a solder adapter.

B. Gate Valves:

1. For Exposed Piping:
 - a. Gate valves shall be resilient wedge type, iron body, bronze mounted. Gates shall open counterclockwise.
 - b. The sealing surface of the cast iron wedge shall have the sealing surface of the wedge permanently bonded with resilient material to meet ASTM D429 tests for rubber to metal bond.
 - c. Gate valves 3-inch diameter and larger shall have flanged end connections, valves less than 3 inches shall have screwed end connections unless otherwise specified.
 - d. Valves shall have nonrising stem with operating nut and handwheel.
 - e. Where indicated on the drawings, valves shall be furnished with a handwheel floor stand type valve operator for use on valves with

non-rising stems. Extension stem shall be bronze with coupling, and the floor stand shall have an integral indicator to show the valve position. The handwheel floor stand operator shall be model F-5500 as manufactured by Clow Valve Company, or approved equivalent. The handwheel operator shall be mounted to the aluminum grating assembly with stainless steel hardware. Extension stem length shall be coordinated in the field by Contractor to suit the requirement application.

f. Manufacturer:

- 1) Clow
- 2) M&H Valve Company

2. For Buried Piping:

- a. Gate valves shall be double disc, iron body bronze mounted. Gates shall open counterclockwise.
- b. Buried gate valves shall have mechanical joint end connections and ductile iron retaining glands.
- c. Valves shall have nonrising stem with 2-inch operating nut.
- d. Each valve shall be provided with a valve box and cover. Valve box shall be two piece cast iron with 5 1/2-inch shaft, screw type.
- e. Manufacturer:
 - 1) Clow
 - 2) M&H Valve Company
 - 3) Or equal.

3. For Copper Piping:

- a. Gate valves shall be bronze body, with solid wedge disc and solder joints.
- b. Valves shall have a union bonnet and rising stem.
- c. Manufacturer:
 - 1) Lunkenheimer.
 - 2) Crane.
 - 3) Or equal.

4. For Steel Piping:

- a. Type: Outside stem and yoke, rising stem, split wedge.
- b. Body: Carbon steel, ASTM A 105.
- c. Stem and Split Wedge: Stainless steel.
- d. Ends: Flanged, ANSI B16.5, Class 150.
- e. Manufacturer:
 - 1) Henry Vogt Machine Company.
 - 2) William Powell Company.
 - 3) Or equal.

C. Check Valves:

1. For Ductile Iron Piping:

- a. Valves shall be swing check type of iron body, bronze mounted construction.
- b. End connections shall be flanged or screwed.
- c. Manufacturer:
 - 1) Lunkenheimer.

2) Or equal.

2. For Copper Piping:

a. Check valves shall be swing check valves of bronze construction and solder joint ends.

b. Manufacturer:

1) Crane.

2) Lunkenheimer.

3) Or equal.

3. For Other Services:

a. Type: Horizontal, swing.

b. Body: Carbon steel, ASTM A 216.

c. Internals: Stainless steel, ASTM A 74.

d. Manufacturer:

1) Jenkins Brothers.

2) Or equal.

D. Ball Valves:

1. For Copper Piping:

a. Ball valves shall be quarter turn, full port ball valve with a nonblowout stem and adjustable packing gland. Valve body shall be cast bronze and valve ball shall be chrome plated brass.

b. Valve packing and seats shall be Teflon.

c. Valve end connections shall be screwed. Provide a screw to sweat adapters where required.

d. Manufacturer:

- 1) Stockham Valves and Fittings.
- 2) Crane.
- 3) Whitey.
- 4) Or equal.

2. For Fuel Oil Piping:

- a. Ball valves shall be quarter turn, SSF63 Series, full port ball valves with a nonblowout stem and adjustable packing gland. Valve body and ball shall be 316 stainless steel. Valve shall be approved by Factory Mutual Systems 6033, and A.P.I. 607. Valves shall be rated for 2200 psi at 100°F.
- b. Valve packing shall be Grafoil. Valve seats shall be spring loaded Teflon seats with Grafoil reinforcement.
- c. Valve end connections shall be screwed or swagelok as shown on the Contract Drawings.
- d. Manufacturer:
 - 1) Swagelok.
 - 2) Whitey.
 - 3) Nipro.
 - 4) Cajon.
 - 5) or equal.

3. For All Other Uses:

- a. Type: Nonlubricated, full port.
- b. Body: Carbon steel.
- c. Ball and Stem: Stainless steel.

- d. Seats and Seals: Teflon.
- e. Ends: Flanged, ANSI B16.5, Class 150.
- f. Manufacturer:
 - 1) Jamesbury Corporation.
 - 2) Or equal.

E. Corporation Stops:

- 1. Corporation stops shall be installed where air binding of pipe lines might occur, or as shown on the Drawings.
- 2. Corporation stops shall be of brass or bronze construction, in accordance with AWWA C800.
- 3. Manufacturer:
 - a. Mueller Company.
 - b. Or equal.

F. Air Release Valve:

- 1. A 2" automatic air release valve shall be installed on the well pump discharge.
- 2. Valve shall be 2" NPT screwed inlet and outlet with cast iron body and top, bronze and brass trim and stainless steel ball float.
- 3. The valve shall satisfactorily withstand a hydrostatic pressure of 300 psi and operating pressure of 125 psi.
- 4. Manufacturer:
 - a. Crispin, Model D20
 - b. Or equal.

G. Solenoid Valves:

1. Solenoid valves where shown or required shall be of packless construction with screwed ends and a threaded conduit connection.
2. All parts in contact with the fluid being handled shall be of noncorrodible construction and suitable for the service indicated. Stainless steel bodies and wetted components shall be provided where indicated on the Drawings.
3. Coils shall be rated for continuous duty, and shall be completely encapsulated in epoxy resin.
4. Valves shall have a manual operator.
5. A strainer shall be installed upstream of each solenoid valve.
6. The valves shall be energized to close unless otherwise shown on Drawings or in Specifications.
7. Solenoid valves shall be suitable for operation on 120 volt, 60 Hz, single phase power.
8. Solenoid valves used in explosion-proof areas shall be suitable for Class I, Division I, Group D or Class I, Division II, Group D as applicable.
9. Manufacturer:
 - a. Automatic Switch Company.
 - b. Magnatrol.
 - c. Or equal.

H. Gauges:

1. Pressure gauge shall be installed on discharge connection to well pump. Air line drawdown gauge shall be installed on well pump head.
2. Materials are as follows:
 - a. Case: Plastic: dust proof

- b. Stainless Steel: bourdon tube
 - c. Cocks Each Gauge: Brass Ball Valves
 - d. Miscellaneous Piping: Brass.
 - e. Snubber: Type 316 Stainless Steel.
 - f. Dial Size: 4 1/2 inches with a plastic case and white face with black markings. Window shall be acrylic with a micrometer adjustable black aluminum pointer.
3. Range:
- a. Scale shall be as required for the application and as approved by the Engineer.
4. Accuracy: $\pm 1/2\%$ of full scale.
5. Manufacturer:
- a. Ashcroft - Model 1279.
 - b. Marsh.
 - c. Or equal.
- I. Sampling Taps: Sampling tap shall consist of a smooth nosed copper sampling tube connected to pressure gauge assembly as shown on the Drawings.
- 1. Nipple - 1/4-inch NPT, brass.
 - 2. Pet Cock - Ball Valve.
 - 3. Copper Tubing - Type "L" tube with end connections sanded smooth without burrs and crimps.
- J. PVC Unions: Unions for chemical service shall have Viton "O" Rings and shall be suitable for use with 15 percent sodium hypochlorite solution.
- K. Reduced Pressure Zone (RPZ) Backflow Preventer:
- 1. The RPZ device shall be of the size shown on the Drawings, shall include two check valves, unions,

test ports, and an automatically operating pressure differential relief valve.

2. The backflow prevention device shall have bronze body, all bronze working parts, bronze ball valves on inlet and outlet, neoprene valve discs, nitrile, fabric reinforced diaphragm, stainless steel springs for the second check valve and relief valve, and stainless steel springs for the first check valve. The backflow prevention device shall be designed for a maximum working pressure of 175 psi, hydrostatically tested to 350 psi and be supplied with a "Y" strainer. Pressure drop for a 1-inch valve of the model specified at 25 gpm shall not exceed 14.0 psi.
3. There shall be two ball valves, a gate valve and a check valve furnished and installed with the backflow preventer device. The manufacturer of the backflow prevention device shall install a test cock with the necessary fittings into the inlet ball valve.
4. The Contractor shall support the backflow prevention device as required.
5. The reduced pressure backflow preventer shall be listed with Underwriters Laboratories and meet the requirements of AWWA C506.
6. The Contractor shall have a New York State Health Department Certified Backflow Prevention Device Tester hydraulically test and certify in writing that the backflow prevention device is operating correctly and meets the intent of the specifications. Results of the test shall be forwarded to the Engineer and the Nassau County Department of Health. The installation and testing of the backflow prevention device must be witnessed by the Engineer or the device and test results will be unacceptable. Replacement and/or retesting of the device shall be at no additional cost to the Owner.
7. The tests shall be conducted twice: Once prior to final approval; and the second time prior to the end of the guarantee period. The aforementioned

second test shall not be performed prior to 11 months after final approval and certification shall be submitted to the Owner in writing before the end of the guarantee period of the Contract.

8. Manufacturer:

- a. Febco, Model 825Y
- b. Or equal.

2.8 MISCELLANEOUS

A. Dry Taps in Pipe:

- 1. Taps and connections to piping shall be made as required to connect equipment, gauges, valves, and where otherwise shown on the Drawings.
- 2. Taps shall be Mueller pipe thread of the size indicated or required.
- 3. Where pipe wall thickness is insufficient for the tap sizes shown, bosses or welding plates shall be added to the pipe or fitting, or an approved saddle may be used. Field welding will not be permitted.
- 4. Threads shall be protected by a brass plug.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Contractor shall inspect all piping to ensure that piping is free of defects in material and workmanship. The compatibility of all pipe, fittings, and coatings shall be verified.

3.2 INSTALLATION

- A. Buried pipe shall be installed in accordance with the requirements of Section 18051. Exposed pipe shall be installed in accordance with the requirements of Section 18052. Valves shall be installed as specified in this Section.

3.3 MISCELLANEOUS FITTING INSTALLATION

- A. Pipe in Wall or Floor Sleeves:
 - 1. The annular space between all wall sleeves and carrier pipes shall be sealed with mechanical link-type seals.
- B. Transitions from one type of pipe to another shall conform with requirements of Sections 18051 and 18052.

3.4 VALVE INSTALLATION

- A. Provide valves and specials in quantity, size, and type with all required accessories as shown on the Contract Drawings.
- B. Install all valves and appurtenances in accordance with manufacturer's instructions.
- C. Install suitable corporation stops at all points shown and required where air binding of pipe lines might occur.
- D. Install all valves so that operating handwheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by Engineer.
- E. Unless otherwise approved install all valves plumb and level. valves shall be installed free from distortion and strain caused by misaligned piping, equipment or other causes.
- F. Installation of all valves, specials and appurtenances shall conform to the requirements of Sections 18051 and 18052 where applicable.
- G. Identification: Provide valve tags as specified under Section 09900.

3.5 SPECIFIC PIPING INSTALLATION

A. Copper Tubing:

1. Joints shall be made with clean bright ends, properly fluxed, using 95 percent tin, 5 percent antimony solder.
2. Runs shall contain unions at connections to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.
3. All horizontal lines shall be properly pitched to facilitate draining and all low points shall be provided with 3/4-inch hose bibbs properly located so that the entire system may be drained.

3.6 FIELD TESTING

A. Leakage Tests:

1. Conform with requirements of Sections 18051 and 18052.
2. All auxiliary devices connected to the main process piping, such as pilot piping and gauges, shall be valved off or disconnected prior to the leakage testing. Upon completion of the tests, all connections shall be reestablished and the section of piping incorporating the auxiliary devices shall be retested at the required pressure.

3.7 CLEANING

- #### A.
- All piping shall be thoroughly cleaned and flushed as approved by the Engineer.

3.8 SURFACE PREPARATION AND PAINTING

- #### A.
- All piping listed in the Schedule to be painted shall be prepared and painted in accordance with the requirements of Section 09900, Painting.
- #### B.
- All valves, except stainless steel and PVC, shall be prepared and field painted in accordance with Section 09900, Painting.

C. All buried bolts and nuts shall be given a heavy coat of asphaltic material in accordance with Section 18051.

+ + END OF SECTION + +

SECTION 18094

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to provide an acceptable system of support, guidance and anchorage for all piping, valves, fittings, ductwork and specials.
2. Hangers and supports for Plumbing and Ventilation are specified herein.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the hangers and supports.
2. Contractor shall coordinate the location and placement of any necessary concrete inserts, and any cutting or drilling of structural members required.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 05120, Structural Steel.
3. Section 05504, Miscellaneous Metal Fabrications.
4. Section 09900, Painting.
5. Division 18, Sections on Piping, Valves and Specials.

1.2 QUALITY ASSURANCE

- A. General: The contractor shall conform to the following general criteria:
1. Materials and systems using stock or production parts shall be utilized unless otherwise shown or approved.
 2. Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment concentration.
 3. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.
 4. Hangers shall be installed so that they cannot become disengaged by movements of the supported pipe.
 5. Conform to the recommendations of MSS-SP-58 and 69 except where requirements of this Section 18094 are more stringent.
- B. Source Quality Control: Obtain each type of pipe hanger or support from no more than one manufacturer.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:
1. The Manufacturers Standardization Society of the valve and Fittings Industry:
 - a. MSS SP-58, Pipe Hangers and Supports - Materials and Design.
 - b. MSS SP-69, Pipe Hangers and Supports - Selection and Application.
 2. FS WW-H-171, Hangers and Supports, Pipe.

3. Underwriters' Laboratories, Inc., Standard UL-203-Pipe Hanger Equipment.
4. ANSI B1.1, Unified Inch Screw Threads.
5. ANSI B31, Codes for Pressure Piping.
6. ASTM A36, Structural Steel.
7. ASTM A47, Malleable Iron Castings.
8. ASTM A235, Carbon Steel Forgings for General Industrial Use.
9. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
10. ASTM A307, Carbon Steel Externally Threaded Standard Fasteners.
11. ASTM A320, Alloy-Steel Bolting Materials for Low-Temperature Steel.
12. ASTM A575, M-Grades Merchant Quality Hot-Rolled Carbon Steel Bars.
13. ASTM A666, Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar for Structural Applications.
14. ASTM A668, Carbon and Alloy Steel Forgings for General Industrial Use.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 1. All hangers and supports for piping system specified.
 2. Location, installation, material, loads or forces, and deflection of all hangers and supports.
 3. Manufacturers' catalogs, literature, and engineering data on all hangers and supports.

4. Load ratings, materials and installation shall be consistent with the recommendations of the MSS SP-58 and MSS SP-69.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: All materials shall be inspected for size, quality, and quantity against approved Shop Drawings.
- B. Storage of Materials: All materials shall be packaged, labeled, and stored in a covered dry location until time of installation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Unless otherwise noted or shown, contractor is responsible for designing and supplying supports for all piping systems.
- B. The hangers and supports shall meet with the following requirements:
 1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.
 2. Run piping in groups and parallel to building walls where practicable. Provide minimum clearance of one inch between pipe and other work.
 3. Install hangers or supports at all locations where piping changes direction. All valves and valve operators shall be rigidly supported independently of the piping.
 4. All valves and valve operators shall be rigidly supported independently of the piping.
 5. All hangers and supports shall be capable of adjustment after placement of piping.
 6. Types of hangers or supports shall be kept to a minimum.

7. All suspended or supported ductile iron pipe and cast iron soil pipe shall have a hanger or support adjacent to each hub.
8. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.
9. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
10. Prevent contact between dissimilar metals by use of copper plated, rubber, vinyl coated, or stainless steel hangers or supports.
11. Hangers and supports shall provide for expansion throughout the full operating temperature range.
12. All ferrous pipes shall be supported by galvanized steel pipe attachment.
13. All copper piping shall be supported by plastic coated or copper plated steel pipe attachments.
14. Plastic piping shall be supported by plastic coated steel pipe attachments.
15. All supports, straps and hardware in clearwell shall be Type 316 stainless steel.
16. Vertical struts and horizontal members shall be of a size suitable for the service intended and be compatible with frame inserts as specified in Section 05504, Miscellaneous Metal Fabrications. Structural steel shall conform to the requirements of Section 05120.
17. Insulated pipes shall have a 300 series stainless steel insulation protection shield a minimum of 12 inches long.

2.2 HANGERS AND SUPPORTS

- A. Components of hangers and supports shall conform to the following where applicable:

1. Materials:

- a. Bolts: ASTM A 307, Grade A, unless otherwise specified below.
- b. Anchor and Expansions Bolts: Type 316 stainless steel, including nuts and washers.
- c. Forgings: ASTM A 235.
- d. Malleable Iron: ASTM A 47.
- e. Rods and Bars: ASTM A 107.
- f. Threads: Unified Screw Threads, Class 2A and 2B, ANSI B1.1.
- g. Structural Steel: ASTM A 36.

2. Finish:

- a. Steel Items: Galvanized unless otherwise specified or shown on the Drawings.
- b. Plastic coated steel where specified above.
- c. Stainless Steel Items: No finish is required.

B. Pipe Attachments: The following types of pipe attachments are acceptable:

- 1. Adjustable Steel Clevis: FS WW-H-171E, Type 1.
- 2. Steel Double Bolt Pipe Clamp: FS WW-H-171E, Type 3.
- 3. Steel Pipe Clamp: FS WW-H-171E, Type 4.
- 4. Adjustable Swivel Pipe Ring: FS WW-H-171E, Type 6.
- 5. Adjustable Steel Band Hanger: FS WW-H-171E, Type 7.
- 6. Riser Clamp: FS WW-H-171E, Type 8.
- 7. Light Duty Clevis Hanger: FS WW-H-171E, Type 12.
- 8. Long Clips: FS WW-H-171E, Type 26.
- 9. Offset J Hooks: FS WW-H-171E, Type 27.

10. Pipe Saddle Support: FS WW-H-171E, Type 37.
11. Pipe Stanchion Saddle: FS WW-H-171E, Type 38.
12. Adjustable Pipe Saddle Support: FS WW-H-171E, Type 39.
13. Insulation Protection Saddle: FS WW-H-171E, Type 40A and 40B.
14. Insulation Protection Shield: FS WW-H-171E, Type 41.
15. Adjustable Pipe Roll and Base: FS WW-H-171E, Type 47.
16. Adjustable Roller Hanger: FS WW-H-171E, Type 44.
17. Pipe Slide Assembly:
 - a. Material: Carbon steel tee with stainless steel slide plate; carbon steel base with filled teflon pad.
 - b. Type: Suitable for field welding to steel pipe. Modify with clamps and U-bolts for use with ductile iron pipe.
 - c. Product and Manufacturer:
 - 1) ITT Grinnell, Figure 257, Type 3.
 - 2) Piping Specialties, Incorporated.
 - 3) Or equal.

C. Structural Attachments: The following types of structural attachments are acceptable:

1. Welded Steel Bracket: FS WW-H-171E, Type 33.
2. Side Beam Bracket: FS WW-H-171E, Type 35.
3. Malleable Concrete Insert: FS WW-H-171E, Type 18.
4. Center I-Beam Clamp with Eye Nut: FS WW-H-171E, Type 28.

5. Side Beam Clump: FS WW-H-171E, Type 20.
- D. Hanger Rod Attachments: Use as required to complete assembly:
1. Forged Steel Clevis: FS WW-H-171E, Type 14.
 2. Adjustable Turnbuckle: FS WW-H-171E, Type 15.
 3. Forged Steel Weldless Eye Nut: FS WW-H-171E, Type 17.
- E. Anchorage Items: All anchor or expansion bolts, nuts and washers for anchoring pipe hangers and supports shall be Type 316 stainless steel where stainless steel piping is installed and Type 304 stainless steel in all other locations. Concrete anchors shall be self drilling type.
- F. All other hangers and supports shall be in accordance with MSS SP-58.
- G. Product and Manufacturer: Provide hangers and supports as manufactured by one of the following:
1. ITT Grinnell Company.
 2. Elcen Metal Products Company.
 3. Or equal.

2.3 SURFACE PREPARATION AND PAINTING

- A. All pipe supports except stainless steel and plastic coated steel for all piping listed in the Schedule to be painted shall be prepared and painted in accordance with the requirements of Section 09900, Painting. All supports shall be painted the same color as the pipe.

PART 3 - EXECUTION

3.1 GENERAL

- A. Locate hangers, supports, and accessories to support piping, valves, and all concentrated loads.

- B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.
- C. All in line devices shall be removable without the need for temporary supports for adjacent and connecting pipe.
- D. Locate hangers and supports to prevent vibration or swaying and to provide for expansion and contraction.
- E. Pipe attachments for insulated pipe shall be large enough to accommodate pipe, insulation and shield.
- F. Install items to be embedded before concrete placement.
- G. Fasten embedded items securely to prevent movement during concrete placement.
- H. Hanger and support units installations methods shall be in accordance with manufacturer's recommendations.
- I. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations. Grout shall be as specified in Section 03300, Cast-In-Place Concrete.

3.2 INSTALLATION

- A. Supports and Hangers for Horizontal Pipes: Space supports and hangers for all piping no farther apart than shown below unless otherwise shown on the Drawings:
 - 1. Copper Tube:
 - a. Pipes up to 2 inches: 6 feet-0 inch center to center.
 - b. Pipes 2 1/2 inches and larger: 8 feet-0 inch center to center.
 - 2. Steel, Ductile Iron and Stainless Steel Pipe:
 - a. Pipes up to 1 inch: 6 feet-0 inch center to center.
 - b. Pipes 1 1/4 inches to 6 inches: 8 feet-0 inch center to center.

- c. Pipes 8 inches and larger: 10 feet-0 inch center to center.
 - d. In addition, ductile iron pipe shall have a minimum of two supports per length and shall have a hanger or support adjacent to each hub.
3. Plastic Pipe: Maximum support spacing for plastic pipe at ambient temperature shall be one-half the above values for steel pipe except that support spacing shall not exceed 4 foot-0 inches.
4. Cast Iron Pipe:
- a. Two supports per length.
 - b. Additional supports shall be placed immediately adjacent to any change in piping direction, and on both sides of valves, expansion joints, and couplings.
 - c. Hanger Rods shall be sized for maximum pipe loads and according to the schedule herein for minimum rod diameters:

<u>Nominal Pipe (inches)</u>	<u>Minimum Rod Diameter (inches)</u>
1/2 through 2	3/8
2-1/2 through 3	1/2
4 through 5	5/8
6	3/4
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

- d. Hangers and supports for pipe 3 inches in diameter and larger shall be adjustable.

B. Supports for Vertical Piping:

- 1. Provide riser clamp placed under hub, fitting or coupling with approved solid bearing on steel sleeve.

2. Where riser clamps are used with plastic piping they shall be modified so as not to exert any compressive forces on the pipe.
3. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.
4. Vertical plastic piping riser clamps shall be PVC coated.

C. Expansion Anchors:

1. Use to fasten all base supports to floors.
2. Use at hangers and brackets to support piping 1 inch in diameter and smaller and only if the anchor is designed to carry 200 percent of the load.

3.3 ACCEPTANCE AND SERVICE

- A. Acceptance: All pipe systems shall be brought up to operating pressures and temperatures. Systems shall be cycled to duplicate operating conditions. All malfunctions shall be corrected. Contractor shall furnish all labor and materials to readjust and correct faults with hangers and supports for the piping systems.

+ + END OF SECTION + +

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SECTION 18096

WALL PIPES, FLOOR PIPES AND PIPE SLEEVES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, materials, equipment and incidentals required to provide all floor pipes, pipe sleeves, wall pipes, other wall pieces, mechanical seals and escutcheons required to complete the Work.
- B. Coordination: Review installation procedures under other Sections and coordinate with the Work which is related to this Section.
- C. Related Work Specified Elsewhere:
 - 1. Division 3, Sections on Concrete.
 - 2. Section 09900, Painting.
 - 3. Division 18, Sections on Piping, Valves and Specials.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:
 - 1. AWWA C100, Cast Iron Pressure Fittings.
 - 2. AWWA C104 (ANSI A21.4), Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water.
 - 3. AWWA C106 (ANSI A21.6), Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water and Other Liquids.
 - 4. AWWA C110 (ANSI A21.10), Gray-Iron and Ductile-Iron Fittings, 2 inches through 48 inches, for Water and Other Liquids.

5. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings.
6. AWWA C115 (ANSI A21.15), Flanged Cast Iron and Ductile Iron Pipe with Threaded Flanges.
7. AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
8. AWWA C200, Steel Water Pipe 6 Inches and Larger.
9. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
10. ANSI B16.4, Cast Iron Screwed Fittings.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 1. Detailed drawings and data on all wall and floor pipes, and pipe sleeves.
 2. Submit and coordinate these with Shop Drawings required for all piping systems.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: On the Drawings, where the type of penetration is not indicated the Contractor shall use either a typical detail as shown on the Drawings or a detail as approved by the Engineer.
- B. Wall and Floor Pipes:
 1. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise shown on the Drawings or approved by Engineer.
 2. End Connections: As shown on the Drawings or approved by the Engineer.

3. Thickness: Same as specified for the piping connected to wall or floor pipe unless otherwise shown or specified.
 4. Provide water stop at mid-point of wall or floor for anchorage and watertightness.
 5. Pipes ends shall be flush with wall or floor face unless otherwise shown, specified or approved by the Engineer.
 6. Flanged ends and mechanical joint bells shall be drilled and tapped for studs. Provide stainless steel studs.
 7. Provide same interior protection as specified for the connecting piping. Exterior protection shall be as specified for buried piping in Section 18051.
- C. Pipe Sleeves: Pipe sleeves shall conform to the details on the Drawings. Where not shown conform to the following as a minimum:
1. Sleeves for Ferrous and Plastic Pipes: Scheduled 40 galvanized steel pipe unless otherwise shown.
 2. Sleeves for Copper Pipe: Type K hard drawn copper pipe unless otherwise shown.
 3. Cast Wall Sleeves:
 - a. Material: Cast iron, ductile iron or Type 316 stainless steel, furnished with integral wall collar.
 - b. Dimensions: As required for mechanical joint or caulked joint pipe to pass through sleeve. Length as required. Minimum pipe sleeve wall thickness shall be as specified in AWWA C110.
- D. Mechanical Modular Seals: Provide link type mechanical/modular seals with adjusting bolts in all pipe sleeves as shown on the Drawings unless otherwise approved by the Engineer, suitable for 20 psi working pressure.
1. Type: Mechanical/Modular seals through clearwell and exterior walls or floors: minimum two

Mechanical/Modular seal assemblies required per installation.

- a. Pressure Plate: Glass reinforced nylon plastic.
 - b. Bolt and Nut: Type 316 stainless steel.
 - c. Sealing Element: EPDM rubber, Silicone rubber.
2. Type: Mechanical/Modular seals through interior walls or floors.
- a. Pressure Plate: Low carbon steel, zinc galvanized plated.
 - b. Bolt and Nut: Low carbon steel zinc galvanized.
 - c. Sealing Element: Silicone rubber, EPDM rubber.
3. Product and Manufacturer: Seals shall be as manufactured by:
- a. Thunderline Corporation.
 - b. Or equal.

2.2 SURFACE PREPARATION AND PAINTING

- A. All exposed surfaces of wall pipes, floor pipes and pipe sleeves shall be prepared and painted in accordance with the requirements of Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall and Floor Pipes: Install as shown and in accordance with approved Shop Drawings.
- B. All penetrations through existing floors, walls or ceilings shall be core-drilled. Chipping shall not be allowed in lieu of core drilling. Contractor shall obtain written approval from the Engineer prior to

making any new penetrations through existing floors, walls or ceilings. Contractor shall drill pilot holes before core drilling to locate any interference with existing conduits, equipment, etc., or to locate existing reinforcing. He shall neatly patch and seal opening after installation of new equipment to match existing walls, floors, ceilings, etc.

C. Pipe Sleeves:

1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs unless otherwise shown.
2. In process areas, all sleeves through floor slabs shall extend a minimum of 2 inches above finished floor.
3. In finished areas, all sleeves through floor slabs shall extend a maximum of 1/4 inch above finished floor.
4. Anchor sleeves to concrete and masonry walls as shown or otherwise approved.
5. Sleeves through walls shall be flush with wall face.
6. Seal annular space between pipe and sleeve with mechanical seals or as approved by the Engineer.
7. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
8. Size sleeves to provide annular space as recommended by the mechanical/modular seal manufacturer and as follows:

<u>Pipe Size</u>	<u>Spacing between Sleeve ID and Pipe or Insulation OD</u>
Less Than 2 in.	1/2 in. to 3/4 in.
2 in. - 4 in.	3/4 in. to 1 1/4 in.
6 in. - 12 in.	1 1/4 in to 2 in.
Over 12 in.	2 in. to 3 in.

9. Do not install sleeves and pipes through concrete columns and beams, and steel members unless specifically shown and approved by Engineer.

+ + END OF SECTION + +

SECTION 18099

LARGE DIAMETER VALVES, SPECIALS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide all valves and appurtenances as shown on the Contract Drawings and specified herein.
2. The Work includes, but is not limited to, all types of valves, 4-inch diameter and larger required for buried, exposed, submerged and other types of piping except where otherwise specifically included in other Sections.

B. Coordination: Review installation procedures under other Sections and coordinate with the Work which is related to this Section including buried piping installation, exposed piping installation, site utilities, insulation, fire protection, heating, ventilating and plumbing.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting.
2. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Valves and appurtenances provided under this Section shall be the standard products in regular production of a valve manufacturer(s).
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. AWWA C500, Gate Valves, 3 through 48 inches NPS, for Water and Sewage systems.
2. AWWA C508, Standard for Swing Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
3. AWWA C509, Standard for Resilient-Seated Gate Valves, for Water and Sewage.
4. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
5. ANSI B16.4, Cast-Iron Screwed Fittings.
6. ANSI A21.11, Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
7. ASTM A48, Gray Iron Castings.
8. ASTM A126, Gray Iron Castings for Valves, Flanges and Pipe Fittings.
9. ASTM A307, Carbon Steel Externally Threaded Standard Fasteners.
10. ASTM A354, Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.
11. ASTM A436, Austenitic Gray Iron Castings.
12. ASTM A536, Ductile Iron Castings.
13. ASTM B62, Composition Bronze or Ounce Metal Castings.
14. ASTM D1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
15. ASTM D2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
16. AGMA Standards.
17. NEMA, National Electrical Manufacturers Association.
18. ISA, Instrument Society of America.

- C. Shop Tests: All valves shall be shop tested at test pressures in accordance with the requirements of applicable AWWA Standards. The manufacturer shall certify that the required tests on the various materials and on the completed valves were performed and the valves were found conforming to the requirements of AWWA Standards.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 - 1. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, size and weight.
 - 2. Fabrication, assembly, installation and wiring diagrams.
 - 3. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
- B. Operation and Maintenance Manuals: Submit complete installation, operation and maintenance manuals, including copies of all approved Shop Drawings, as specified in Section 01730, Supplementary Mechanical and Electrical Requirements.
- C. Certificates of shop testing of valves as specified in Paragraph 1.2,C.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle all valves and appurtenances very carefully. Valves which are cracked, dented or otherwise damaged or dropped will not be acceptable.
- B. Store all valves and appurtenances in an approved enclosed shelter off the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. All valves shall have manufacturer's name and working pressure cast in raised letters on valve body.
2. All manual valve operators shall turn clockwise to close the valves. An arrow with the word "close" shall be cast on each operator to indicate direction of closing.
3. All flanged valves shall have ends conforming to ANSI B16.1, Class 125.
4. All bolts, nuts and washers required to connect flanged valves in the clearwell shall be of Type 304 stainless steel.
5. Exposed flanged valve connections shall be with bolts, nuts, and washers conforming to ASTM A 307, Grade B; or ASTM A 354.
6. All bolts and nuts shall have hexagon heads. Gasket material shall be suitable for the specified service.

B. Gate Valves:

1. For Exposed Ductile Iron Pipe:
 - a. Exposed gate valves shall be ductile iron body resilient wedge type conforming to ANSI/AWWA C509. Gate valves 4 inches and larger shall be rated for 200 psig working pressure.
 - b. Rubber shall be permanently bonded to the disc per the requirements of ASTM D429.
 - c. All gate valves shall open counter-clockwise, shall be furnished without bypasses and shall be suitable for vertical or horizontal mounting.

- d. Gate valves shall be furnished with flanged ends and nonrising stems and as shown on the Contract Drawings.
- e. Exposed, manually operated gate valves shall be equipped with handwheels.
- f. Where indicated on the drawings, valves shall be furnished with a handwheel floor stand type valve operator for use on valves with non-rising stems. Extension stem shall be bronze, and the floor stand shall have an integral indicator to show the valve position. The handwheel floor stand operator shall be model F-5500 as manufactured by Clow Valve Company, or approved equivalent.
- g. Manufacturer:
 - 1) Clow Corporation.
 - 2) M and H Valve Company.
 - 3) Kennedy Valve Manufacturing Company.
 - 4) Mueller.
 - 5) Or equal.

2. For Buried Ductile Iron Pipe:

- a. Gate valves shall be resilient seat, cast iron body coated inside and outside with fusion bonded epoxy in accordance with AWWA C550. Gates shall open counterclockwise. Gate shall be constructed of cast iron and fully encapsulated in a compounded elastomer.
- b. Buried gate valves shall have mechanical joint end connections and ductile iron retaining glands.
- c. Valves shall have nonrising stem with 2-inch operating nut.

d. Each valve shall be provided with a valve box and cover. Valve box shall be two piece cast iron with 5½-inch shaft, screw type.

e. Manufacturer:

1) Clow

2) M&H Valve Company

3) Or equal.

C. Check Valves - Swing Arm Type:

1. Unless otherwise shown or specified, check valves shall be cushioned swing check type, constructed with heavy cast iron body and stainless steel seat ring. Valves shall be configured for vertical or horizontal mounting as shown on the Contract Drawings with ANSI B16.1 Class 125 flanged ends.

2. Check valves shall absolutely prevent the return of liquid back through the valve when the inlet pressure decreases below the delivery pressure. Valves shall be designed for full pipe diameter flow passage.

3. Materials of Construction:

a. Body, Cover Disc, Levers, Disc: Cast Iron (ASTM A126 C1.B).

b. Disc Arm, cast steel (ASTM A216 C1.WCB).

c. Seat, stainless steel (ASTM A157-C9).

d. Hinge shaft, stainless steel (Type 303).

e. Studs, bolts, nuts, hardware (stainless steel type 303, 304 or 316).

f. Cushion Chamber Assembly (Bronze) (ASTM B62).

4. The valves shall be rated for a minimum working pressure of 150 psig.

5. The valve shall be tight seating and equipped with external lever and weight for operation without hammer or shock. The location (left hand/right hand) of the lever and weight assembly shall be as approved by the Engineer.
6. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering actions. The cushion chamber shall be arranged that the closing will be adjustable to meet the service requirements.
7. Manufacturer:
 - a. G.A. Industries Inc., Model 250-DA.
 - b. Or equal.

D. Butterfly Valves:

1. For Exposed Ductile Iron Pipe:
 - a. Butterfly valves shall be cast iron, one-piece lug type body conforming to AWWA C504.
 - b. Valve shafts shall be one-piece stainless steel.
 - c. Disc shall be aluminum-bronze.
 - d. Seats shall be rubber and shall be bonded to valve body. Seats shall be designed to be leak tight in both directions at the specified pressures.
 - e. End flanges shall conform to ANSI B16.1 Class 125.
 - f. Valves shall be rated for 200 psig in the closed position at 212°F.
 - g. Manufacturer:
 - 1) Dezurik

- 2) Clow
- 3) Pratt
- 4) Or equal

2. Manual Actuators:

- a. Manual actuators shall have all gearing totally enclosed.
- b. Actuators shall be designed to produce the required operating torque with a maximum rim pull of 80 lb. on the handwheel.
- c. Adjustable stop limiting devices shall be provided for the open and closed positions.
- d. Actuators shall have position indicators and shall clearly indicate the direction of rotation to open and close the valve.

3. Electric Actuators:

- a. Where electric motor operators are indicated, an electric motor-operated control unit shall be attached to the valve or gate operating mechanism housing by means of a flanged motor adaptor piece.
- b. Gearing: The motor operator shall include the motor, reduction gearing, reversing starter, torque switches, and limit switches in a weatherproof NEMA 4 assembly. The operator shall be a double reduction unit consisting of spur or helical gears and worm gearing. The spur or helical gears shall be of hardened alloy steel and the worm gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease or oil lubricated, in a sealed housing. Ball or roller bearings shall be used throughout. Operator output speed changes shall be mechanically possible by simply removing the motor and changing the exposed or helical

gearset ratio without further disassembly of the electric operator.

- c. Starting Device: The unit shall be so designed that a hammer blow is imparted to the stem nut when opening a closed valve or closing an open valve. The device should allow free movement at the stem nut before imparting the hammer blow. The operator motor must attain full speed before stem load is encountered.
- d. Switches and Wiring: Travel in the opening and closing directions shall be governed by a switch responsive to mechanical torque developed in seating the valve or gate, or by an obstruction met in opening or closing the valve or gate. The torque switch shall be adjustable and shall function without auxiliary relays or devices. A calibration tag shall be mounted near each switch correlating the dial setting to the unit output torque. Microswitch elements or devices relying on coil springs shall not be used in the torque switches. The geared limit switches shall be of the open type and shall be actuated by a rotor cam with 4 contacts to each cam or gear train. The operator shall have a number of gear trains as required to produce the operation indicated. Position limit switches and associated gearing shall be an integral part of the operator. To provide the best possible accuracy and repeatability, limit switch gearing shall be of the "counting" intermittent type, made of stainless steel, grease lubricated, and enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train. Switches shall not be subject to breakage or slippage due to over travel. Traveling nuts, cams, or microswitch tripping mechanisms shall not be used. Limit switches shall be of the heavy duty open contact type with rotary wiping action. The operator shall be wired in accordance with the schematic diagram and all wiring for external connections shall be

connected to marked terminals. One 1-inch and one 1-1/4-inch conduit connection shall be provided in the enclosing case.

- e. Handwheel Operation: A permanently-attached handwheel shall be provided for emergency manual operation. The handwheel shall not rotate during electrical operation. The maximum torque required on the handwheel under the most adverse conditions indicated herein shall not exceed 60 lb-ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb. An arrow and either the word "open" or "close" shall be cast on the handwheel to indicate the direction to turn said handwheel.
- f. Motor: The motor shall be of the totally-enclosed, non-ventilated, high-starting torque, low-starting current type for full voltage starting. It shall be suitable for operation on 120-volt, 1-phase, 60-Hz current, and have Class F insulation, and a motor frame with all dimensions in accordance with the latest revised NEMA Standards. The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 40 degrees C when operating continuously for 15 minutes under full rated load. With a line voltage of not more than 10 percent above or 10 percent below the rated voltage, the motor shall develop full rated torque continuously for 15 minutes without causing the thermal contact protective devices, imbedded in the motor windings, to trip or the starter overloads to drop out. All bearings shall be of the ball type and thrust bearing shall be provided where necessary. All bearings shall be provided with suitable seals to confine the lubricant and prevent the entrance of dirt and dust. Motor conduit connections shall be watertight. Motor construction shall incorporate the use of stator and rotor as independent components from the valve or gate operation such that the failure of either item shall not require operator disassembly

or gearing replacement. The motor shall be provided with a space heater suitable for operation on 120-volt single-phase circuit.

- g. Motor Starter: There shall be furnished and installed in the integral weatherproof housing on the valve or gate, unless otherwise indicated, a suitably sized amperage rated reversing starter with its coils rated for operation on 120-volt, 1-phase, 60-Hz current. A control power transformer shall be included to provide a 120-volt source. The starter shall be equipped with 3 overload relays of the automatic reset type. There will be a remote Open-Close-Off-Auto switch (by others) to control the valve. A remote signal for valve position (1 normally open and 1 normally closed dry contact) shall be transmitted to the pump control system. Its control circuit shall be wired as indicated on the Electrical Drawings. The controls compartment shall contain a suitably sized 120-volt ac single-phased space heater to prevent moisture condensation on electrical components.

h. Controls:

- 1) Local Control - There shall be a "Auto-Manual" selector switch and "Open-Stop-Close" selector switch remote to the valve. These switches shall be housed in a NEMA 12 enclosure, located remote to the actuator. A minimum of six (6) fully adjustable limit switches shall be provided for use in accomplishing the control sequence.
- 2) Automated Operation - When the "Auto-Manual" switch at the well station is in "Auto," the valve shall be controlled from a remote blowoff valve control panel and shall accept dry contact outputs from the control panel to open and close the valve.

- i. Enclosure: Unless otherwise indicated, motor, and all electrical enclosures, shall be rated NEMA 4.
- j. Manufacturer:
 - 1) Limitorque Corporation, Model L120-10 with WTRA-12 gears.
 - 2) Or equal.

E. Pressure Sustaining Check Valves

- 1. The pressure-sustaining valves associated with the well pumps shall be closed when the associated pump is off. When the pump is started and after the blow off valve has closed, the rising inlet head shall cause the valve to open slowly at a field adjustable rate. The valve shall compensate for fluctuations in system pressure, maintaining a minimum backpressure against the pump. When the pump is signaled to shut down, the backpressure valve shall close on falling inlet head after the blow off valve has opened.

If during a power or pump failure, a pressure reversal occurs, downstream pressure is admitted into the cover chamber and the valve shall close drip tight to prevent return flow.

- 2. When the valve is in the open position, a limit switch shall provide indication of valve position. When the valve is in the closed position, a limit switch shall provide indication of valve position. A third limit switch shall provide confirmation that the valve is in the open position for use as a sodium hypochlorite chemical safety.
- 3. The pressure sustaining valve shall be globe pattern as described in these specifications. The valve body and cover shall be ductile iron ASTM A-536, and shall be equipped with stainless steel trim, (T303). The end details shall be 150ASA class flanged ends conforming to ANSI standards B16.42, with a maximum working pressure of 250 psi. All wetted ferrous surfaces shall be epoxy-

coated by the fusion process and shall be NSF approved.

4. The main valve shall be a hydraulically operated, pilot controlled, diaphragm type valve. The main valve shall have a resilient disc, having a rectangular cross section, contained on three and one half sides by a disc retainer and forming a tight seal against a single renewable seat; quad rings and "O" rings are not acceptable.
5. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a threaded removable T303 SS bearing in the valve cover and by an integral bearing in the threaded removable T303 SS valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface.
6. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve or pilot controls.
7. All necessary repairs shall be possible without removing the main valve from the line.
8. The pilot control shall be a direct-acting, adjustable, spring loaded, diaphragm valve, designed to open when the valve inlet pressure exceeds the set point. The pilot system shall also include an orifice "Y" strainer assembly, a valve stem position indicator and cover mounted limit switches as shown on the Drawings and specified herein (SPDT).
9. Pilot control adjustment range shall be 0 - 75 psi for the valves associated with the well pumps.
10. Upon reasonable notification, an authorized factory agent shall be available for ½ day (4 hours on site) to perform the valve start-up services. Also, the authorized factory agent shall be available to the owner for a separate

1/2-day (4 hours on site) service training session.

11. The valve shall carry a three-year warranty from the date of shipment from the factory, provided the valve has been installed and used in accordance with all applicable instructions; and used in service for which it is designed.
12. The valve shall be Model 50-01 Pressure Sustaining Valve as manufactured by the Cla-Val Co., as distributed by Harper Haines Fluid Control (203) 693-3740. The District has standardized all valve materials and only exact equivalent designs shall be evaluated for approval.

F. Solenoid Operated Blowoff Valves

1. The solenoid operated blowoff valve shall be a self-contained unit consisting of a diaphragm-operated packless main valve, a diaphragm-operated high capacity auxiliary valve and a packless three-way solenoid pilot valve. The valve shall either open wide or close drip tight. The three-way solenoid pilot alternately applies pressure to or exhausts pressure from the diaphragm chamber of the high capacity auxiliary valve which in turn causes the same action in the main valve. When the valve is in the open position, a limit switch shall provide indication of valve position. When the valve is in the closed position, a limit switch shall provide indication of valve position. The valve shall close when the solenoid valve is energized.
2. Main Valve: The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern valve. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not

permitted and there shall be no pistons operating the main valve or pilot controls.

3. Main Valve Body: No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process. Total shipping weight shall be equal or greater in all respects to the Hytrol 100-01/100-20 body. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.
4. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
5. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with

synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

6. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6" and smaller size valves shall be threaded into the cover and body. Valve seat in 8" and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.
7. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment, provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.
8. The size of the valve shall be as shown on the contract drawings.

9. The valve body and cover shall be constructed of ductile iron ASTM A-536, and shall be equipped with stainless steel trim, (T303). The end details shall be 150ASA class flanged ends conforming to ANSI standards B16.42, with a maximum working pressure of 250 psi. All wetted ferrous surfaces shall be epoxy coated by the fusion process and shall be NSF approved.
10. The valve manufacturer shall provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and the design point where cavitation damage may occur.
11. A 1/2-inch copper water service shall be installed as shown on the drawings to provide an independent operating pressure to the valve to allow valve operation when the pump is not operating. The valve shall be furnished with a dual supply schuttle valve to direct either the valve inlet pressure or the independent operating pressure to the valve pilot control system, based upon the higher pressure signal.
12. The valve shall be provided with a check feature to prevent reverse flow when pressure reversal occurs. The valve shall be designed to be in a normally open position, with the valve closing upon energizing the pilot control solenoid.
13. The valve shall be provided with opening and closing speed control functions, a flow clean strainer installed in the pilot piping system, an atmospheric drain, and a 'Y' type strainer.
14. The Contractor shall provide the services of a manufacturer's representative to visit the site for 1 day (8-hours on site) to perform for start-up service, inspection, training of owner's staff in operation of the valve, and necessary adjustments.
15. The pilot control shall be a three-way solenoid valve controlled by an external electrical power source. The pilot system shall include strainers,

shut-off cocks and manual operator. Opening and closing speed control needle valves shall be utilized so as to prevent surging of the system on start-up and shut-down. Solenoid shall have a NEMA 4 enclosure.

16. The solenoid controlled blowoff valve shall be a Cla-Val Co. Model No. 136-03/636-03 Solenoid Control Valve, as manufactured by Cla-Val Co., and distributed by Harper Haines Fluid Control (203) 693-3740. The District has standardized all valve materials and only exact equivalent designs shall be evaluated for approval.

G. Limit Switches

1. Where Limit Switches are shown or specified to be installed on hydraulic valves specified in this section, Limit Switches shall be furnished and installed by the valve manufacturer.
2. The Limit Switch Assembly shall be designed to provide electrical switching indication of the position of hydraulic control valves. The switch shall be mechanically actuated by the opening or closing of the valve on which it is mounted.
3. A stainless steel actuating stem with a swivel adapter fastened directly to the main valve stem shall move through an adapter and gland with two O-ring seals allowing the stop collar to actuate the micro switch bracket mounted on the exterior of the adapter which shall be attached to the cover of the main valve.
4. The single pole, double-throw micro switch shall be connected to open or to close the circuit when actuated. It shall be easily adjusted to operate at any point of the valve's travel simply by loosening the Allen screw and raising or lowering the collar on the actuating stem. The electrical switch shall be in weatherproof rated NEMA 4. All assemblies shall be capable of accommodating up to three switches. Standard materials in contact with operating fluid shall be brass, stainless steel, monel and Buna-N.

5. This valve shall be a Cla-Val Co. Model No. X105L/X105L2 Limit Switch Assembly, as manufactured by Cla-Val Co., and distributed by Harper Haines Fluid Control (203) 693-3740.

2.2 VALVE APPURTENANCES

- A. Identification: Provide valve tags as specified under Section 09900.

2.3 SURFACE PREPARATION AND SHOP PAINTING

- A. Surface preparation and shop painting are required for all ferrous metals, equipment and accessories, and shall be as specified under Section 09900, Painting.
- B. Ferrous metal internals of valves shall be painted in accordance with the applicable AWWA Standards.
- C. Items of equipment shall be finish painted by the manufacturer in accordance with Section 09900. Color shall be as approved by the Engineer. If any damage to the paint system occurs during delivery, the equipment shall be repainted as directed by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The valves and appurtenances shall be installed by the Contractor in accordance with the details shown on the Drawings, and in accordance with approved Shop Drawings and manufacturer's instructions. Installation shall include furnishing all required oil and grease for initial operation. Grade and types shall conform to the manufacturer's recommendations.
- B. Provide valves in quantity, size, and type with all required accessories as shown on the Drawings. Install all valves and appurtenances in accordance with manufacturer's instructions.
- C. Install suitable corporation stops at all points shown and required where air binding of pipe lines might occur.

- D. Install all valves so that operating handwheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by Engineer.
- E. Unless otherwise approved, install all valves plumb and level. Valves shall be installed free from distortion and strain caused by misaligned piping, equipment or other causes.
- F. Installation of all valves, specials and appurtenances shall conform to the requirements of Sections 15051 and 15052 where applicable.

3.2 FIELD TESTS AND ADJUSTMENTS

- A. Adjust all parts and components as required to provide correct operation.
- B. Conduct functional field test of each valve in presence of Engineer to demonstrate that each part and all components together function correctly.
- C. Test all installed valves hydrostatically with the corresponding piping at test pressures specified in Sections 18051 and 18052. Valves shall withstand full test pressures without any visible leakage. All necessary testing equipment and labor shall be provided by the Contractor. Valves found defective shall be repaired or replaced at the Contractor's expense.
- D. The Contractor shall provide the services of the backpressure control valve manufacturer for conducting testing and startup of the completed pumping and/or treatment system. The manufacturer or his designated representative shall visit the site at a time acceptable to the Owner to provide two (2) 1/2-days of adjustment and training to Owner's personnel for the purpose of starting up the completed system and instructing the Owner's personnel in the operation of valve pressure setting equipment.

+ + END OF SECTION + +

SECTION 18175

DISINFECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Contractor shall be responsible for the disinfection of all potable water lines with compliance to codes and regulations as specified herein.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Building Codes: Comply with applicable requirements of all governing authorities and the following codes:
 - 1. New York State Uniform Fire Prevention and Building Code.
 - 2. Nassau County Department of Health.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified: AWWA C 651, Standard for Disinfecting Water Mains except that the tablet method specified in Section 5.1 will not be acceptable.
- C. Testing: Bacteriological tests as specified below shall be provided by the Contractor.

1.3 SUBMITTALS

- A. Submit a description of the forms of chlorine, dosages, and proposed methods of application to the Engineer for approval.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all necessary equipment and materials, including chemicals, to perform the disinfecting operations.

PART 3 - EXECUTION

3.1 DISINFECTION

- A. General: The method to be followed shall be that prescribed by the local authorities or, in accordance with the procedures recommended by AWWA C651, Section 5.2 or 5.3 except the tablet method of chlorination as described in Section 5.1 of AWWA C651 will not be permitted:
1. Before application of chlorine, flush the piping system with potable water at a velocity of not less than 2.5 feet per second.
 2. After the applicable retention period, flush the system using potable water.
- B. Testing: Perform bacteriological tests in accordance with AWWA C651. The disinfection procedure shall be repeated until satisfactory bacteriological sampling has been achieved.
- C. Coordination: The Plumbing Contractor shall coordinate the testing and disinfection of the piping with the testing and disinfection of the Nitrate Treatment System to be performed by the General Construction Contractor.

+ + END OF SECTION + +

SECTION 18180

MISCELLANEOUS APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Contractor shall furnish all labor, tools, materials, and equipment necessary for providing miscellaneous appurtenances as shown on the drawings and as specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Section 18380, Packed Tower Aeration System Control Panel.
 - 2. Section 18099, Large Diameter Valves, Specials and Appurtenances.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 - 1. Illustrations, specifications and engineering data including: dimensions, materials, size, weight, coatings and linings and any other design data.
 - 2. Certificates: Submit certificates of compliance with referenced standards.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: All materials shall be inspected for conformance with shop drawings.
- B. Storage of Materials: All materials shall be packaged, labeled, and stored in a covered dry location until time of installation.

PART 2 - PRODUCTS

2.1 FLOAT SWITCHES

- A. Six float switches for Booster Pump and Transfer Pump Control shall be provided in each clearwell as shown on the drawings and as specified herein.
- B. The float switches shall be mercury free with a snap action switch activated by a steel ball rolling within a switching tube.
- C. The float housing shall be polypropylene. The external weight shall be Type 316 stainless steel.
- D. The switches shall be provided with a sufficient length of cable.
- E. The switches shall be rated for 7 amps at 115 Volts AC and 3.5 amps at 230 Volts AC.
- F. The switches shall be mounted to a support pipe which is attached to the clearwell wall.
- G. The high-high level float switch shall be normally closed, open on rising level. The low-low, low and high float switches shall be normally open, close on rising level.
- H. Manufacturer:
 - 1. Anchor Scientific, Eco-Float, Model GP.
 - 2. Or equal.

2.2 WALL-MOUNTED HOSE RACKS

- A. Wall-mounted hose racks shall be installed at all hose bibbs. Racks shall be of all-welded steel construction, minimum 8-gauge sheet steel, hot-dip galvanized after fabrication, and shall have a capacity to hold 100 feet of 3/4-inch hose.

2.3 HOSES AND NOZZLES

- A. The work includes the following quantities of the lengths indicated:

1. One 75-foot length of 3/4-inch hose.
- B. Hose shall include male and female connectors and nozzle and shall be seamless, extruded rubber with dacron cotton exterior and shall be designed for a working pressure of at least 200 psi.
- C. Nozzles shall be capable of complete shutoff and shall produce a solid straight stream and up to a 90-degree conical fog. One nozzle shall be provided for each hose specified. Nozzle material shall be brass with polished finish, and nozzles shall include rubber bumper.

2.4 AUTOMATIC SUBMERSIBLE SUMP PUMPS AND BASINS

- A. Automatic sump pumps shall be furnished and installed at locations shown on the Drawings.
- B. The sump pump shall be furnished with dimensions that will allow the pump unit to fit within the sump shown on the Drawings.
- C. The sump pump shall be equipped with a 1 1/2-inch NPT female discharge fitting and couplings, nipples and reducers to connect to the sump pump discharge piping shown on the Drawings. A 1 1/2-inch clamp style union and full flow check valve shall be furnished on the pump discharge. A 3/16-inch vent hole shall be drilled in the discharge pipe below the check valve and basin cover to purge the system of trapped air.
- D. Pump housing shall be constructed of cast iron with a 100% baked on powder coated epoxy finish. All fasteners and external metal parts shall be stainless steel. Pump impeller shall be of vortex non-clog design. Pump shall be capable of passing 1/2-inch solids.
- E. Pump shall be equipped with 1/3 HP, 115 VAC, 60Hz, 1 phase, thermally overload-protected, and automatically resetting motor. Motor shall be hermetically sealed, submersible type operating in a dielectric oil with a ceramic-carbon shaft seal.
- F. Pump operation shall be automatic, and pump shall be furnished with an integral, mechanical float controlled switch factory set and not requiring any additional equipment for operation.

- G. At 15-feet of dynamic head, pump shall perform at 19 gallons per minute when pumping clean water.
- H. Pump shall be Model No. 53, as manufactured by the Zoeller Pump Company, or approved equal.

2.5 FIRE EXTINGUISHERS

- A. The Contractor shall furnish and install two (2) fire extinguishers of approved carbon dioxide, portable aluminum tank type containing ten (10) pounds of liquefied carbon dioxide, complete with hanger, seat type valve, 3 feet of hose and non-shatterable discharge hose and bracket for wall mounting.
- B. Fire extinguishers shall be mounted as directed by the Engineer.
- C. Manufacturer:
 - 1. Pemall Inc., Model PACD10.
 - 2. Or equal.

2.6 PRESSURE TRANSMITTER

- A. Pressure transmitter shall be capable of detecting pressure in a pipeline over a range of 0-150 psig with 0.25% full scale accuracy.
- B. Device shall be constructed with a cast aluminum housing with an integrated LED display calibrated to locally display pipeline pressure in psig.
- C. Wetted components shall be fabricated from 316L stainless steel. Device shall be suitable for use with process liquids from 0-200° F.
- D. Pressure transmitter shall provide 4-20 mA output signal and shall demonstrate 50 msec response time.
- E. Process connection shall be ¼-inch male NPT. Contractor shall provide pipe tap for installation.

- F. Pressure transmitter shall be Model 626 Industrial Pressure Transmitter as manufactured by Dwyer Instruments.

2.7 VENTURI METER

- A. The Contractor shall furnish and install venturi type flow meters as shown on the drawings, specified herein and as required for a complete installation.
- B. The venturi shall be made of cast iron ASTM A126 Grade B with a 304 stainless steel throat liner. The cylindrical throat length shall be equal to at least one half of the throat diameter.
- C. The venturi shall have two sets of inlet pressure and throat pressure taps located 180° apart. The inlet tap shall be bushed with 304 stainless steel. Vent and drain holes shall be located 90° from the pressure taps.
- D. Venturis having annular chambers will not be accepted. The included angle of the recovery cone shall be 10° or less.
- E. The venturi ends shall be flanged and drilled for 150 psig service per ANSI B16.1.
- F. The venturi shall be hydrostatically tested by the use of blind flanges, thus loading them in tension at 350 psig for a minimum of 15 minutes.
- G. The cast iron interior of the meter shall be properly coated with epoxy paint suitable for contact with potable water, if applicable, and the exterior shall be coated with factory primer.
- H. The metering design of the venturi shall sense true static pressure at the inlet and throat. This criterion is satisfied if the sum of the sensed pressures and calculated velocity heads at the inlet tap and throat tap cross sections indicate the real total energy content of the flowing fluid at those cross sections.
- I. The throat diameter of the venturi located downstream of the packed tower shall be designed to accurately

develop static pressure signals from process flow of up to 2,400 gpm through the venturi. Beta ratio shall be 0.5. The nominal diameter of each venturi shall be 16-inches in diameter.

The throat diameter of the venturis located downstream of the well pumps shall be designed to accurately develop static pressure signals from process flow of up to 1,200 gpm through the venturi. Beta ratio shall be 0.5. The nominal diameter of the venturi shall be 10 inches in diameter.

J. Manufacturer's Service:

1. The manufacturer shall certify that the meter to be furnished meets the general intent of the specifications and shall list all deviations from the specifications that exist.
2. In addition, the manufacturer shall furnish shop drawings, operation and maintenance manuals, certifications of pressure testing, descriptive data, list of 10 similar installations, and all other information requested by the Engineer.
3. No meter shall be shipped prior to obtaining approval of the shop drawings by the Engineer.

K. Manufacturer:

1. Primary Flow Signal, Inc., Model HVT-CI.
2. Or approved equal.

2.8 FLOW (DIFFERENTIAL PRESSURE) TRANSMITTER

- A. Flow transmitter shall be of the intelligent series and shall utilize silicon strain gauge sensor technology coupled to microprocessor based electronics.
- B. Output shall be coupled to a communications network to allow remote reconfiguration and self diagnostic data transfer over the standard 2-wire signal connection terminals. Transmitter shall incorporate temperature compensation sensors to eliminate the effect of temperature changes on the transmitter output. All

transmitter configuration and calibration shall be performed with a hand-held terminal. Connection of hand-held terminal shall not require disturbing the signal wiring. Special junction boxes for remote connections shall not be permitted.

- C. Accuracy of transmitter shall be ± 0.1 percent for an output of 4 to 20ma with a repeatability of .05 percent of calibrated span. Suppression shall be configurable to the upper range limit minus the calibrated span utilizing the hand-held calibrator. Transmitter shall have a two-line digital indicator with calibration pushbuttons to display the process measurement in any selected units.
- D. Transmitter shall be housed within a gasketed, weatherproof NEMA 4X enclosure. Sensor housing shall be type 316 stainless steel with 1/2-inch NPT process connections. Flow transmitter shall be furnished with stainless steel three (3) valve manifold bolted to transmitter sensor housing and mounting hardware to allow bleeding of air from the process piping and zeroing of the pressure signal for testing.
- E. Flow transmitter shall send a 4-20 mA flow signal to the flow metering equipment as shown on the Drawings.
- F. Manufacturer:
 - 1. Foxboro Model IDP10-D-20-B-1-1-F-M1-L1-H-V-ECC as supplied by the Eagle Control Corporation, Yaphank, New York.
 - 2. Or approved equivalent.

2.9 STEPLADDER

- A. The Contractor shall furnish one aluminum folding stepladder with anti-slip treads. Stepladder shall have two (2) steps and shall support 300 lbs.
- B. Manufacturer:
 - 1. Little Giant, Model 10210B
 - 2. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The miscellaneous appurtenances shall be installed by the Contractor as shown on the Drawings and in accordance with approved Shop Drawings and the manufacturer's instructions.

+ + END OF SECTION + +

SECTION 18250

PIPE INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide insulation for piping as shown on the drawings and as specified herein.

B. Coordination: Insulation shall not be installed until piping has been field tested and approved by the Engineer.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting.
2. Division 18, Plumbing.

1.2 QUALITY ASSURANCE

A. Manufacturer's and Installer's Qualifications: Manufacturer and installer shall have at least 5 years experience in producing similar type materials and show evidence of at least 5 installations in satisfactory operation.

B. Design Criteria: Insulation systems including covering, mastics, adhesives, sealers and facings shall have the following fire hazard classifications:

1. Flame spread, 25 maximum.
2. Smoke developed, 50 maximum.

C. Source Quality Control: Provide certified test data for the following tests and inspections:

1. Flame spread.
2. Smoke developed.

D. Requirements of Regulatory Agencies:

1. Permits: Contractor shall obtain and pay for all required permits, fees, inspections and approvals by authorities having jurisdiction.
2. Building Codes: Comply with applicable requirements of all governing authorities and the following codes:
 - a. New York State Uniform Fire Prevention and Building Code.
 - b. New York State Energy Conservation Code.
3. Underwriters' Laboratories, Incorporated. Fire hazard ratings to be verified by Underwriters' Laboratories, Inc. label or listing or a certified test report from an approved independent testing laboratory.
4. National Fire Protection Association.

E. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. Federal Specification HH-I-558B, Insulation Blocks, Boards, Blankets, Felts, Sleeving, Pipe Fitting Covering.
2. ASTM C 547, Mineral Fiber Preformed Pipe Insulation.
3. ASTM E 84, Surface Burning Characteristics of Building Materials.

F. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.

1.3 SUBMITTALS

A. Samples: Submit for approval samples of the following:

1. Fiberglass insulation.
2. Weatherproof insulation jacket and fitting covers.
3. Vapor Barrier.

B. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Manufacturers' catalog literature, specifications, and illustrations with the following information:
 - a. Thermal properties.
 - b. Physical properties.
 - c. Fire hazard ratings.
 - d. Facing information.
 - e. Installation instructions.
 - f. Jointing recommendations for butt joints and longitudinal seam.
2. Fabrication instructions for pipe fittings and valve insulation and coatings.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Material: Material shall be delivered to the job site in corrugated cartons.

B. Storage of Material:

1. Store material in clean, dry area, out of the weather.
2. Material shall be tightly covered to protect against dirt, water, and mechanical or chemical damage.
3. Material shall remain in original cartons until time of installation.

1.5 JOB CONDITIONS

A. Protection:

1. Insulating materials shall, at all times, be protected from moisture.
2. Material shall be stored on or near the job site and drawn from this protected area as used.

3. All material applied in one day shall have the vapor barrier applied the same day and any exposed ends shall be temporarily protected with a moisture barrier and sealed to the pipe or equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Insulation:

1. Manufacturer: Provide one of the following:
 - a. Schuller International.
 - b. Owens Corning Fiberglass Corporation, Fiberglass 25ASJ/SSL.
 - c. Certain-Teed Products Corporation, Certain-Teed 500 F snap-on ASJ-SSL.
 - d. Or equal.
2. Type: Heavy density sectional pipe insulation with vapor barrier and self-sealing lap.
3. Density: 6 pounds per cubic foot, minimum.
4. Fittings: Molded fiberglass.
5. Jointing Materials: Manufacturers recommended adhesives and tape.
6. Valve Insulation: Miter cut nesting size covering segments of same thickness as pipeline, for insulation of valves.

B. Weatherproof Insulation Jacket:

1. Manufacturer: Provide one of the following:
 - a. Johns Manville, Zeston 2000 PVC.
 - b. Or equal.
2. Type: Smooth PVC.
3. Thickness: 20 mil, minimum.

4. Fastening: Solvent welded.
- C. Insulated Fitting Covers:
1. Manufacturer: Provide one of the following:
 - a. Johns Manville, Zeston 2000 PVC.
 - b. Or equal.
 2. Type: Factory fabricated PVC jacketing for elbows, tees, valves, flanges, end caps, beveled collar fitting covers, etc.
 3. Thickness: 20 mils.
 4. Reference: Conform to ASTM E84.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Insure that surfaces of all pipes, valves, and fittings are clean and dry before applying insulation.

3.2 PREPARATION

- A. Insure that piping and equipment has been tested, painted, inspected and released for application of insulation.

3.3 INSTALLATION

- A. Pipe insulation shall be continuous through walls and floor openings except where walls or floors are required to be firestopped or required to have a fire resisting rating or required to be gas tight.
- B. Install insulation so as to make surfaces smooth, even, and substantially flush with adjacent insulation.
- C. Follow manufacturer's application instructions for all materials used.
- D. Provide insulation protection shields for insulated piping supported by pipe hangers. The metal shall be 300 series stainless steel and a minimum of 12 inches long.

- E. Install and coat insulation in accordance with the manufacturer's recommendations.
- F. Insulation for buried pipe shall be wrapped in tape as recommended by the manufacturer. No weatherproof jacket is required.

3.4 FIELD QUALITY CONTROL

- A. Insure that insulation is dry when installed, before and during application of any finish.

3.5 SCHEDULE

- A. Refer to Paragraphs 1.1.A. for piping to be insulated. See schedule below for minimum thickness of pipe and fittings insulation:

<u>Pipe Size</u>	<u>Minimum Insulation Thickness (inches)</u>
1) All piping:	
1/2" thru 1"	1
1-1/4" thru 2"	1-1/2
4" and larger	2

+ + END OF SECTION + +

SECTION 18284

PHOSPHATE STORAGE AND FEED SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Under this Section, the Contractor shall furnish and install one (1) phosphate metering pump system and a new storage tank, complete and fully operational, including metering pump, valves, piping and modifications to existing storage tanks and accessories as shown on the Contract Drawings and as specified herein.

B. Related Sections:

1. Section 18400, Water Treatment Chemical Safety Control System.
2. Section 18068, Small Diameter Piping, Fittings and Specials.
3. Section 18094, Pipe Hangers and Supports.
4. Section 18096, Wall Pipes, Floor Pipes and Pipe Sleeves.

1.2 SUBMITTALS

- A. Submit shop drawings of all equipment to be provided under this section in accordance with Section 01342.
- B. Submit detailed piping layout plan and schematic showing existing building dimensions, existing and proposed tank locations, wall penetrations, offsets around related piping, pipe supports, connections to existing piping and injection locations.

PART 2 - PRODUCTS

2.1 PHOSPHATE METERING PUMPS

- A. The phosphate metering pump shall be a peristaltic type pump capable of delivering the metered solution from the storage container into the pressurized discharge main as specified herein.
- B. The metering pump shall be designed and built for 24-hour continuous service, shall provide automatic de-gassing of the metered fluid, and shall be self-priming up to 25 feet of head against pressure.
- C. The peristaltic delivery mechanism shall be equipped with a triple roller assembly mechanism. Bearings shall be constructed of Oilite type hardened steel. Housing shall be constructed of polycarbonate plastic and shall be chemically resistant to phosphate.
- D. Feed control rate shall be adjusted by means of an indexed feed control plate and manually adjustable dial ring.
- E. The pump shall be capable of delivering 40 gallons per day of solution at a discharge pressure of 100 psig when the roller assembly is rotating at 60 rpm.
- F. The pump discharge tubing shall be equipped with a check valve duckbill manufactured from Santoprene material with an integral polycarbonate plastic housing.
- G. Phosphate pump housing shall be of chemically resistant glass fiber reinforced thermo-plastic. All exposed fasteners shall be stainless steel. Phosphate metering pump valves shall be ball type, with ceramic balls. Valve seat and seal ring shall be renewable by replacing the combination seat-seal ring or cartridge valve assembly. Pump head shall be PVC material capable of resisting the pumped chemical. Fittings and connections at pump head shall be PVC.
- H. Spare parts: Each metering pump shall be provided with the following spare parts:
 - 1. Three (3) additional peristaltic metering tubes for roller assembly.

2. One (1) additional gear service kit.
 3. One (1) additional motor service kit.
- I. Electrical characteristics shall be 115 volts, 60 Hz, single phase. Pump motor shall be hard wired by the Electrical Contractor, as shown in the Contract Drawings.
- J. Manufacturer:
1. Classic Series Model 85MHP40, as manufactured by the Stenner Pump Company, Jacksonville, Florida.
 2. Or approved equal.

2.2 PHOSPHATE STORAGE TANK AND ACCESSORIES

- A. Contractor shall provide for the phosphate treatment system one 40-gallon linear polyethylene storage tank. One system shall be provided under this contract. The tank shall be cylindrical with a diameter of 18 inches and height of 40 inches. Wall thickness shall be a minimum of 5/16 inches. Tank shall be self-supporting and shall be equipped with an airtight cover. The tank shall be a translucent construction to allow visual determination of the liquid level in the tank. The tank shall be provided with a graduated volumetric gauge on the tank wall to indicate tank volume in gallons with 10-gallon graduated intervals.
- B. The phosphate storage tank shall be provided with a containment tank, constructed of linear polyethylene. The phosphate containment tank shall be constructed with a minimum volumetric capacity of 110% of the volumetric capacity of the phosphate storage tank. The phosphate containment tank shall be of rectangular construction, with a depth of 20 inches, a width of 20.5 inches and a length of 20.5 inches wall thickness shall be 1/4-inch. The phosphate containment tank shall have a capacity of 45 gallons and shall be of open top construction.
- C. The phosphate containment tank shall be supported by a polyethylene floor grating, minimum 1 1/4 inches high, to extend beyond the tank base on all sides.

D. Manufacturers:

1. Phosphate Storage Tank:

- a. Chem-Tainer Industries, Inc.
- b. Or approved equal.

2. Phosphate Containment Tank:

- a. Chem-Tainer Industries, Inc.
- b. Or approved equal.

3. Polyethylene Floor Grating:

- a) Catalog number 6273T41 as manufactured by McMaster-Carr Supply Co., New Brunswick, New Jersey.
- b) Or approved equal.

2.3 PHOSPHATE SYSTEM ACCESSORIES

A. The new phosphate storage tank shall be fitted with a new self-aligning bulkhead fitting on the tank cover to allow the solution transfer piping to enter the tank without the cover being removed. The bulkhead fitting shall attach to the tank cover by a threaded compression assembly, and shall be constructed of PVC with Viton elastomers. The penetration opening shall be 1/2-inch diameter.

1. Manufacturer:

- a. Poly Processing, Self Aligning Universal Ball Dome, Flange Style.
- b. Or approved equal.

B. Provide ceramic weight, foot valve and strainer on suction tube for each pump.

C. The metering pump shall be furnished with two ball valves. These valves shall be placed one in the influent line and one in the effluent line for the

metering pump. The ball valves shall be compatible with phosphate and suitable for use with tubing.

- D. A bypass valve shall be provided. Tubing shall be returned to the tank.
- E. Provide drip pans under each pump to match existing.

2.4 FLEXIBLE PVC BRAIDED TRANSFER PIPING

- A. Flexible PVC braided chemical transfer piping shall be provided to convey phosphate solution from the storage tank into the discharge main, as shown on the Contract Drawings.
- B. Tubing shall be flexible PVC with an integral braid. Inside diameter shall be 1/4-inch. Tubing shall be NSF approved for potable water use. Maximum working pressure shall be 250 psi. Minimum bend radius of the tubing shall be 3 inches. All fittings shall be serrated nipples constructed of nylon and secured with stainless steel hose clamps. Tubing shall be supported to walls with clamps and stainless steel expansion anchors on 3-foot centers.

2.5 PHOSPHATE INJECTOR ASSEMBLY

- A. Contractor shall furnish and install an injector assembly to introduce phosphate solution into the discharge main as shown on the Contract Drawings. Injector assembly shall be Wallace & Tiernan Corporation Lock, Catalog No. 145030, or approved equal. Injector assembly shall be provided with a retaining ball valve and chain.

2.6 ANIT-SIPHON VALVE

- A. Furnish and install an anti-siphon valve for the pump. Anti-siphon valve shall be Griffco G Series or approved equal.

2.7 NAMEPLATES

- A. The phosphate metering pump and tank arrangement shall be provided with an engraved plastic identification sign to indicate the well pump associated with the treatment system. Signs shall be installed on the

masonry wall behind the tank and above the metering pump with expansion anchors. Signs shall be white with black lettering; minimum 6 inches on each side with 1-1/2 inch high lettering and shall read, "Phosphate System - Well Pump No. X." Where "X" is the number of the well pump associated with the treatment system.

- B. Signs shall be provided as required to match existing signs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contract Drawings: Contract Drawings for the pump and piping layout are general and may be modified as required for the installation of the equipment furnished. If any departures from the Contract Drawings are deemed necessary by the Contractor, details of such proposed departures and the reasons therefore shall be submitted in writing for approval as soon as practicable. Such departures shall be made only after written approval of the Engineer and at no additional cost to the Owner.
- B. Workmanship: Materials and equipment shall be installed to conform with the Contract Documents, in accordance with the approved recommendations of the manufacturer and the applicable Standards of the Hydraulic Institute. The installation shall be accomplished by workmen skilled in the type of work required under this section of the Specifications.
- C. Equipment shall be painted in accordance with Section 09900. All machined surfaces subject to corrosion shall be coated with an easily removed rust preventative compound prior to shipment.

3.2 MANUFACTURER'S SERVICES

- A. The Contractor shall furnish the services of an accredited representative of the phosphate metering pump manufacturer who shall supervise the installation, adjustment, field tests and initial operation of the equipment.

+ + END OF SECTION + +

SECTION 18300

PACKED TOWER AERATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work:

1. The Contractor shall furnish and install a Packed Tower Aeration System in accordance with the requirements of this section to serve the Levittown Water District's Well 7A and 8A Station.
2. A single manufacturer shall furnish the materials and equipment listed below:
 - a. Two air stripping towers operated in series including packing media, connections, and influent pipe.
 - b. Centrifugal blowers and associated air measuring stations and flow transmitters, air inlet filters and housings, louvers, aluminum ductwork and expansion joints, pressure switches and flow switches to provide sufficient air to treat Wells 7A and 8A (specified in Section 18320).
3. All equipment in this section shall be furnished by the manufacturer of the air stripping towers who shall be responsible for the design, coordination and functioning of the equipment specified. The air stripping tower manufacturer shall verify that each component of the packed tower aeration system is compatible with all other components, that piping and ductwork sizes are appropriate and that all devices necessary for proper operation of the equipment have been provided.

B. Related Work Specified Elsewhere:

1. Section 18320 - Centrifugal Blowers.

2. Section 18380 - Packed Tower Aeration System Control Panel.

1.2 SUBMITTALS

A. The following shall be submitted in accordance with Section 01342.

1. Manufacturer's Catalog Data for packed tower and all accessories.
2. Fabrication Drawings.
3. Design Data.
4. Factory Test Reports.
5. Field Test Reports.
6. Certificates.
7. Operation and Maintenance Manuals.
8. List of Similar Installations.
9. Current copy of the manufacturer's ASME Certification of Authorization.
10. Process Design Summary for the controlling compounds, including Henrys Law Constant, mass transfer coefficient (kla), stripping factor, packing height, liquid loading rate, and air to water ratio.
11. Structural Calculations.
12. Base Ring and Discharge Sleeve Details.
13. Packing Support Plate Structural Calculations.
14. Pressure Loss Calculations for Air Handling Equipment.
15. Dimensional Data.

1.3 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The packed tower aeration system shall be designed for a flow rate of 2,400 gpm and the following conditions:

Compound	NYSDOH			
	Design Influent Conc. (ug/l)	Drinking Water Standard (ug/l)	Design Effluent Conc. (ug/l)	Required Removal Efficiency (%)
1,1-Dichloroethane	5.8	5	<1	82.76
1,1,2-Trichloro-1,2,2-Triflouroethene	8.6	5	<1	88.37
Tetrachloroethene	12	5	<1	91.68
Trichloroethylene	420	5	<1	99.76

- B. The air stripping tower manufacturer shall select and size all components of the system to conform with the specified design criteria. Component sizes and materials of construction shall meet or exceed the quality standards specified herein.
- C. The air stripping towers and influent piping shall be designed to allow the expansion of media depth by 5 additional feet in height by adding an intermediate tower shell section in the future to expand the tower packed bed depth.

PART 2 - PRODUCTS

2.1 AIR STRIPPING TOWERS (PACKED TOWER AERATOR)

- A. The air stripping towers shall be manufactured by Layne Christensen Company, Water Treatment Division, 97 Chimney Rock Road, Bridgewater, New Jersey, or approved equal. The towers shall each have a minimum nominal diameter of 11.5 feet and an overall height of 25.0 feet.
- B. Each tower and influent piping shall be structurally and mechanically designed to permit a future increase of 5 feet in height in the upper portion of the packed bed. The future addition shall include 5 feet of packing media, an additional packing support plate and

an additional stainless steel orifice type distribution tray.

- C. The air stripping tower manufacturer shall have a minimum of 10 years experience in the manufacturing of air stripping towers for potable water treatment. The manufacturer shall submit to the Engineer a list of five similar installations in the continental United States of 10-foot diameter or larger towers, fabrication from aluminum, including: location, contact person and phone number, unit size, unit capacity and year installed.
- D. Each tower shall be constructed entirely of 5000 Series Structural Grade Aluminum conforming to the standards of the Aluminum Association. Design snow and wind loads shall be as per New York State Building Code or relevant American National Standard Institute Codes whichever is greater; the design wind load shall be negligible, as the tower shall be housed within a masonry structure. Earthquake and vibrational effects shall be considered in accordance with New York State Building Code. The tower shall be completely self-supporting when anchored to a suitable concrete base. Each tower shall be properly rolled, welded and reinforced where required. Design and drawings shall be certified to conform the current standards of the New York State Building Code and sealed by a Professional Engineer licensed to practice in New York State. The towers shall have a minimum thickness of 3/16-inch.
- E. Welding of each tower and internal components shall be performed by welders qualified in accordance with the latest ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. All welds shall be continuous. The air stripper shall be constructed in a fabrication shop which has an ASME "U" stamp. Manufacturer shall submit a copy of his current ASME Certificate of Authorization.
- F. Sufficient anchoring points shall be provided to be compatible with the concrete slab design that supports the tower. No guy wires or other supporting devices will be permitted. All fasteners shall be type 316 Stainless Steel.

- G. Each tower shall be provided with the following connections:
- 1 - flanged air outlet with size as shown on the Drawings
 - 1 - flanged influent water connection as shown on the Drawings
 - 3 - 24-inch diameter flanged and bolted manways with stainless steel hardware
 - 2 - 1/2-inch sampling taps (influent and effluent)
- H. Manways shall be located immediately above the packing support tray and immediately above and below the influent distribution tray.
- I. Each tower shall be provided with a base anchoring sleeve fabricated from 304 stainless steel, base anchor ring, lifting lugs and support brackets for piping. Base anchor ring and sleeve shall be designed to safely transmit the maximum overturning moment imposed by wind and earthquake to the concrete base structure.
- J. A flanged joint shall be provided in each tower shell between the top of the packed bed and the bottom of the distributor tray. The flange shall allow for the installation of additional tower shell and packing to allow the packed bed depth to be expanded in the future.
- K. A flanged joint shall be provided in each tower shell between the distributor tray and mist eliminator assembly such that the distributor assembly can be removed from the shell in one piece.
- L. Attachment points shall be welded adjacent to the upper manway such that a portable ladder and fall arrestor device may be attached when needed to allow safe access to the upper manway.
- M. The exhaust air stream shall exit the tower through a 30-inch diameter flanged face, circular duct in the side of the tower above the mist eliminator.
- N. A ground lug shall be provided at the base of the tower for the possible future connection to a lighting protection system.

2.2 PACKING MEDIA

- A. High efficiency packing media shall be provided to yield an effective packing depth of 17 feet in the tower. Packing media shall conform to the following design criteria. No alternates will be accepted.

Media Configuration:	Jaeger Tripack
Material:	Polypropylene
Diameter (inches):	2
Specific Surface (sf/cf):	48
Void Volume (%):	93.5

- B. The pressure drop under the operating conditions of 11,230 cfm airflow and 2,400 gpm water flow shall not exceed 0.03-inch of water per foot of packing.

2.3 TOWER INTERNAL COMPONENTS

- A. One packing support plate shall be provided and shall be compatible with the packing furnished. The support plate shall be constructed of fiberglass reinforced plastic (FRP) grating. The support plate shall be designed and supported so that the maximum deflection in the tray is less than 1/4-inch when supporting the tower operating load. Span and deflection tables shall be submitted for the grating furnished. Calculations shall be submitted showing the maximum design load. Shop drawings shall show the number and location of all required grating supports.
- B. A distributor tray shall be provided to uniformly distribute the water flow over the surface of the packing and uniformly collect the exhaust air. The distributor shall be capable of handling a water flow rate of 2,400 gpm. The distributor tray shall be constructed entirely of Type 304 stainless steel and be complete with influent velocity breaker, air exhaust stacks, and distributor orifices. The air exhaust stacks shall be sized to provide a gas velocity not exceeding 25 feet per second. The distributor orifices shall be sized to retain a static head of water in the tray at a flow rate of 2,400 gpm. The tray shall be provided with a welded sidewall of a height 1-inch greater than the maximum water depth or 6 inches, whichever is greater. The bottom of the tray

shall be stiffened to withstand the maximum hydrostatic head anticipated without excessive deflection. The structural design shall conform to the standards of the AISC. The tray shall be completely self-supporting and mounted to a peripheral ledge around the inside diameter of the tower shell. The tray shall be removable through the top of the shell with the mist eliminator section removed. Welding of the tray assembly into the shell will not be permitted. Spray nozzles or pipe distributors will not be acceptable.

- C. Liquid redistribution rings shall be provided at even intervals throughout the height of packing, as required for efficient packing performance. A minimum of three redistribution rings shall be provided.
- D. A moisture separation system shall be provided which will eliminate water droplets in the exhaust air stream. A 4-inch thick polypropylene mesh-type mist eliminator equivalent to the inside diameter of the tower shall be provided for this purpose. All air outlet openings on either the tower or exhaust louvers shall be provided with 24 mesh insect screens.
- E. The exhaust air stream shall exit the tower through a 30-inch diameter flanged face, circular duct in the side of the tower above the mist eliminator.
- F. A collection system for the lower tower sampling tap shall be provided. The collection system shall consist of an aluminum angle piece spanning the diameter of the tower and sloped to allow a sample of water to flow to a sample tap mounted on the exterior of the tower.

2.4 BLOWER

- A. A centrifugal type blower and electric motor shall be furnished and installed to achieve the required tower performance requirements. The blower shall be provided with an acoustical intake louver, air inlet filter and housing, aluminum intake and discharge ductwork, expansion joints, an air measuring station, pressure switch, differential pressure gauge and flow switch.

- B. The centrifugal blower and appurtenances shall conform to Section 18320 - Centrifugal Blower.

2.5 TOWER INFLUENT PIPING

- A. Influent piping shall be Schedule 10, Type 304 stainless steel and shall extend from inside the tower at the center of the water distribution tray to a flanged face 5 feet above the bottom of the tower. Influent piping shall be sized for the design flow of 2,400 gpm and as recommended by the air stripping tower manufacturer. The influent pipe shall be provided with a 150-pound flange at the elevation of the top of the packed bed to allow for the installation of additional piping should the tower and piping need to be extended in the future.

2.6 FASTENERS

- A. All fasteners used to assemble the tower shell, piping, accessories and ductwork shall be type 304 stainless steel.

2.7 TOWER INSULATION

- A. Provide insulation on all tower sections.
- B. Tower insulation shall be a 2-inch thick flexible elastomeric thermal insulation; AP/Armaflex as manufactured by Armacell, or approved equal.
- C. Insulation shall be adhered to the tank with an air-drying contact adhesive; Armaflex 520 Adhesive as manufactured by Armacell, or approved equal.
- D. Insulation joints shall be butted together and sealed with an elastomeric thermal insulation tape, AP/Armaflex Insulation Tape, as manufactured by Armacell, or approved equal.

PART 3 - EXECUTION

3.1 PRESSURE TESTING

- A. The air stripping tower shell shall be pressure tested at three times the rated blower static pressure to

ensure the shell is free of imperfections such as cracks, pinholes or incomplete welds. The testing shall be performed by the tower manufacturer in the manufacturer's facilities. Each tower shell shall hold the required pressure for one hour and soap solution shall be used to positively locate imperfections. All such problems shall be corrected and the unit retested before approval.

- B. The air stripping tower manufacturer shall notify the Engineer five days before any such tests are conducted to provide the opportunity for direct inspection by the Owner's representative.
- C. An accurate log of the test shall be recorded and submitted to the Engineer along with the manufacturer's certification that the test was performed and accepted.

3.2 MANUFACTURER'S SERVICES

- A. The manufacturer shall certify that the equipment to be furnished meets the general intent of the Specifications and shall list all deviations from the detailed Specifications that exist in the equipment to be furnished.
- B. The manufacturer shall furnish shop drawings, descriptive data, list of installations, and all other information requested by the Engineer.
- C. No equipment shall be manufactured prior to obtaining approval of the shop drawings by the Engineer.
- D. Upon completion of the installation work, the manufacturer shall furnish the Engineer with certification that the equipment has been installed properly.
- E. The manufacturer shall furnish three copies of the instructions for installing, operating, maintaining and lubricating the equipment and a year's supply of lubricants.
- F. The installation of the tower shell, tower packing, blower, louver, and the air duct assemblies shall be

under the direct supervision of the tower manufacturer's field representative.

- G. A plywood template shall be provided by the air stripping tower manufacturer to ensure accurate setting of the tower shell anchoring sleeve and anchor bolts. The Contractor shall provide and install type 304 stainless steel anchor bolts and plastic anchor bolt sleeves, as required.
- H. The air stripping tower manufacturer shall provide a field technician for two (2) days of installation supervision, one day of operator training and 5 days of system startup/shakedown. During startup, on-site tests shall be performed with a portable gas chromatograph furnished by the tower manufacturer to provide immediate data on the packed tower system's performance.

3.3 GUARANTEE

- A. The equipment furnished under this Section shall be guaranteed by the manufacturer for a period of one year from the date of final acceptance thereof, against defective materials, designs and workmanship. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced promptly at no expense to the Owner.

+ + END OF SECTION + +

SECTION 18320

CENTRIFUGAL BLOWER

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: The air stripping tower manufacturer shall furnish all labor, materials, equipment and incidentals required to provide two centrifugal blower complete with air handling equipment, including intake louver, air inlet filters, aluminum ductwork, expansion joints, transition pieces, air measuring station and all accessories for each tower as shown on the Drawings or specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 18300, Packed Tower Aeration System.
 - 2. Section 18380, Packed Tower Aeration System Control Panel.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall have at least 5 years experience in producing similar type equipment for packed tower aeration water treatment systems and shall show evidence of at least 5 installations in satisfactory operation.
- B. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
 - 1. National Fire Protection Association.
 - 2. Underwriters Laboratories, Incorporated.
 - 3. National Electric Code.
 - 4. National Electric Manufacturers Association.
 - 5. Local and State Building Codes and Ordinances.

- a. New York State Uniform Fire Prevention and Building Code.
 - b. New York State Energy Conservation Code.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- 1. Air Moving and Conditioning Association (AMCA) Standard: 210-74 and 300.
 - 2. ASME Section 9 standards.
- D. Source Quality Control: Perform the following tests and inspections at factory: Blowers shall be statically and dynamically balanced after any required coatings have been applied.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
- 1. Blower dimensions and arrangement including motor mounting provisions.
 - 2. Materials of construction.
 - 3. Mounting details.
 - 4. Coordinated layout drawing showing proposed clearances to adjacent equipment.
 - 5. Performance Data - AMCA approved blower curves, for each model specified, noise data for blower and all accessories.
 - 6. Manufacturer's literature, illustrations, specifications and engineering data.
 - 7. Pressure drop calculations, including losses for ductwork and all air handling components.
 - 8. Plan and elevation drawings showing blower and air handling equipment in relation to air stripping tower.

B. Test Reports: Submit the following test certifications for approval.

1. AMCA Label.

C. Operation and Maintenance Data: Furnish Operation and Maintenance Manual for all items of equipment furnished under this Section. The manual shall include maintenance instructions, copies of approved shop and installation drawings for all equipment and manufacturer's recommended lubricant and spare parts lists including, but not limited to the following:

1. Manufacturer's Catalog Data.
2. Drawings.
3. Design Data.
4. Factory Test Reports.
5. Field Test Reports.
6. Certificates.
7. Operation and Maintenance Data.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Blower shall come completely assembled with motor shipped loose.
2. Intake and discharge parts shall be protected against entry of foreign objects.

B. Storage of Material:

1. Store units in a clean, dry area, out of the weather.
2. Unit shall remain in original crate or skid until time of actual installation.
3. Unit shall be tightly covered to protect against dirt, water, mechanical or chemical damage.

1.5 GUARANTEE

- A. In addition to the manufacturer's standard guarantee, the air stripping tower manufacturer shall include the services of a factory-trained serviceman to provide repair service for the equipment for the period of one year commencing with the time the equipment is placed in continuous permanent operation. This service shall include the cost of all replacement parts required during the interval.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL BLOWER

- A. Product and Manufacturers: Provide one of the following:
1. Chicago Blower Corporation
 2. American Fan Company.
 3. Hartzell Fan, Inc.
 4. Greenheck.
 5. Or equal.
- B. Construction and Design:
1. Each blower shall be capable of delivering 11,230 cfm at 19.25 inches of water static pressure.
 2. Each blower shall be a Class III belt-driven design, single width, single inlet, Arrangement #2. Fan speed shall not exceed 3,000 RPM and blower brake horsepower shall not exceed 50 HP.
 3. The blower housing shall be a minimum 12 gauge sides and 12 gauge scroll, and base shall be a heavy gauge commercial quality carbon steel suitable for temperature up to 250°F. The housing and wheels shall be continuously welded in compliance with ASME Section 9 standards. The

wheels shall be commercial quality carbon steel with double thickness airfoil blades and have non-overloading horsepower characteristics; minimum wheel diameter is 24.5 inches. The wheel shall be mounted to the fan shaft with a split taper bushing. The shafts shall be ground and polished.

4. The fan bearings shall be heavy duty, self-aligning ball bearings with lip seals, depending on fan size, motor HP and performance, and relubricable for continuous service. They shall have a minimum L10 life of 70,000 hours.
5. The blower shaft shall be 2-3/16 inch medium carbon steel (1040-45 SAE) and shall not operate above 70% of the first critical speed and shall be turned, ground and polished.
6. The belts shall be an oil, heat and static-resistant type oversized for continuous duty. The belt drive shall be sized with a service factor not less than 2.0. Drives shall be of the V-belt type with constant pitch.
7. Lifting lugs shall be provided for ease of handling and installation.
8. The blower shall be supplied with an OSHA belt and shaft guard which combines guarding of the drive as well as protection from the weather; inlet flange-drilled, outlet flange-drilled, adjustable motor slide rail base plate, manual outlet damper and intake guard.
9. The blower assembly shall be dynamically balanced at the factory prior to shipping. All blowers shall meet the balance requirements of the Acoustical Society of America Standard ASA STD2-1975 (ANSI S2 19-1975), Grade G2.5. The fan performance shall be based on tests conducted in the manufacturer's AMCA certified laboratory, and conducted in accordance with the latest Revision of AMCA Test Codes #210 (AIR) and AMCA #300 (Sound). Air and sound performance shall be AMCA certified and licensed to bear the AMCA seal.

C. Motors:

1. The blower motor shall be squirrel cage induction type electrical motor. The motor size shall be a 60 HP designed for 460 volt, 3 phase, 60 Hz service. The motor shall be a TEFC motor with a service factor of not less than 1.15. The motor shall be a premium efficiency and energy conserving design, manufactured in accordance with NEMA specifications, NEMA B torque requirements, and Class F non-hydroscopic insulation with Class B temperature rise. The motor shall be inverter duty rated, complying with NEMA MG1 Part 31. The motor shall be non-overloading for all points of operation.
2. The motor shall be manufactured by a recognized domestic manufacturer.
3. Motor thrust bearings shall be adequate to carry continuous thrust loads under all conditions of fan operation.
4. Lubrication may be grease or oil type.

D. Painting:

1. The blower shall be coated with polyester TGIC powder coat electrostatically applied inside and outside and baked to cure the finish. The blower shall be finish painted by the Contractor after installation is complete to ensure that all defects in finish occurring in shipment or installation are corrected.
2. Finish paint shall be as specified in Section 09900 - Painting.

E. Spare parts:

1. Two set of bearings for the specified blower.
2. Four V-belts for the specified blower.

F. Blower Schedule:

<u>Function</u>	<u>Remark</u>	<u>Model No.*</u>	<u>No. Req.</u>	<u>Cap (CFM)*</u>	<u>Static Press (in Water)*</u>	<u>Max RPM</u>	<u>HP*</u>	<u>Elect. Charac. (Volts/Hertz/phase)</u>
Stripping Tower Supply	Centrifugal Blower	BCS-245-Belt Drive	2	11,230	19.25	3,000	50	460/60/3

* Model Nos. specified are as manufactured by the American Fan Company.

* Capacity, static pressure, and horsepower (HP) specified are a minimum. Exact design criteria shall be determined by the Air Stripping Tower Manufacturer.

2.2 INLET AIR FILTERS AND FILTER HOUSING

- A. Blower Filters shall be UL900 Class 2 rated. Provide 4-inch deep throwaway pleated media type filters. Filter media shall be a 100% synthetic lofted to a uniform depth of 0.15-inch and formed into a uniform radial pleat. Filter efficiency shall be determined in accordance with ASHRAE Standard 52.2 with a minimum MERV 14 rating. Filter holding frame shall include centering dimples, multiple fastener lances and polyurethane filter sealing gasket.
- B. Filters shall have dual access doors as dictated by accessibility for the specific site plan. Access doors shall be swing open type and include neoprene gasket to ensure door-to-filter seal. Access doors shall be equipped with adjustable and replaceable positive sealing UV-resistant star-style knobs and replaceable door hinges.
- C. Provide pressure tabs and fittings for installation of differential pressure indicator gauge.
- D. A welded wire grid, spot-welded and treated for corrosion resistance shall be bonded to the downstream side of the media to maintain radial pleats and prevent media oscillation.
- E. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air

exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.

F. Manufacturer: Provide the following:

1. Purolator, Model FBA, size 3H x 3W.
2. Or approved equal.

G. Spare Parts:

1. Four sets of replacement filter elements for specified filter housing.

2.3 INTAKE LOUVER

- A. Furnish 4-inch fixed louvers where shown, or scheduled. Drainable blades shall incorporate a front lip gutter and recessed second gutter, both of which direct water to jamb and mullion drains.
- B. Aluminum sheet shall be alloy 6063-T5 with temper as required for forming or as otherwise recommended by the metal producer to provide the required finish. Aluminum extrusions shall be alloy 6063-T52.
- C. Free Area Velocity: Maximum 550 feet per minute free area velocity at a pressure drop of not more than 0.04-inches water gage carrying less than 0.01 ounces of water per square foot of free area.
- D. All blades shall be 0.081-inch thick. Provide all blades with integral drainage trough along edge of blades. Frame shall be 0.125-inches thick.
- E. Free Area: Not less than 24.28 square feet for a 72-inch by 78-inch high louver.
- F. Fastenings shall be of same material as items fabricated. Provide types, gages and length to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise specified. Use continuous aluminum closure angles on the inside perimeter frame of all louver work, finished to match louvers.

- G. Provide louver supports designed to carry 25 pounds per square foot wind load.
- H. Install removable louver bird screen, 1/2-inch square stainless steel wire, 0.063-inch diameter wire, behind the louver.
- I. The louver shall be furnished with a Kynar flouropolymer finish, applied and baked at the factory. Color shall be selected by the Owner.
- J. Manufacturer: Provide one of the following:
 - 1. Greenheck Model ESD-635, 72" W x 78" H.
 - 2. Or approved equal.

2.4 AIRFLOW MEASURING STATION

- A. Air measuring station shall be FAN-Evaluator as manufactured by Air Monitor Corporation, Santa Rosa, CA, or equal.
- B. The airflow measuring station shall contain multiple total and static pressure sensors positioned at the center of equal and symmetrical areas of the station cross-section, and interconnected by their respective averaging manifolds. For stations of 4 square feet or smaller, one total pressure sensor shall be present for every 16 square inches of station area. Midsize stations greater than 4 square feet but less than 16 square feet shall have one total pressure sensor for every 36 square inches of station area. Stations larger than 16 square feet shall have total pressure sensors spaced a maximum of 12 inches apart.
- C. The airflow measuring station shall be fabricated of a minimum of 14 ga. galvanized steel, welded casing in 8" depth with 90 connecting flanges in a configuration and size equal to that of the duct it is mounted into. Each station shall be complete with an open parallel cell air straightener/equalizer honeycomb mechanically fastened to the casing and external signal connection fittings. An identification label shall be placed on each station casing listing model number, size, area and specified airflow capacity.

- D. The maximum allowable pressure loss through the station shall not exceed 0.015" w.c. at 1,000 fpm, or 0.085" w.c. at 2,000 fpm. Each station shall be capable of measuring the airflow rate within an accuracy of 2% as determined by USGSA certification tests. The station(s) shall have a self-generated sound rating of less than NC 40, and the sound level with the duct shall not be amplified.

2.5 AIR FLOW TRANSMITTER

- A. The mass flow transmitter shall be capable of receiving flow signals (total and static pressure) from an airflow station or probe array equipped with a temperature sensing means, internally performed density correction for the process temperature, and produce individual outputs linear and scaled for standard air volume or mass flow, and temperature.
- B. The mass flow transmitter shall contain an integral graphic LCD for use during the configuration and calibration process, and be capable of indicating multiple process parameters (temperature, flow, dp, etc.) during normal operating mode. All transmitter parameter setting, zero and span calibration, and display scaling will be performed digitally in the on-board microprocessor via input pushbuttons.
- C. The mass flow transmitter shall be provided with a range of 0.05 IN w.c. to 10.0 IN w.c. with an accuracy of 0.1% of natural span. The transmitter shall be furnished with a transducer automatic zeroing circuit and be capable of maintaining linear output signals on applications requiring 10 to 1 velocity (100 to 1 pressure) turndown. The transmitter shall be capable of having its operating span electronically selected without having to perform recalibration involving an external pressure source.
- D. The transmitter shall operate on a 24V DC power supply and shall provide a 4-20mA output for air flow.
- E. The mass flow transmitter shall be the Veltron DPT-plus as manufactured by Air Monitor Corporation, Santa Rosa, California, or equal.

2.6 SAFETY SWITCHES AND GAGES

A. Pressure Switch and Differential Pressure Gage:

1. Pressure switch and differential pressure gage for air service shall be specifically designed for use in an air service application.
2. The switch shall have visible set point and on-off indicators.
3. The gage shall have visible indication of differential pressure measured across the filter housing, and shall be spanned to match filter element performance for the proposed system equipment defined in this section.
4. The pressure switch shall be normally closed.
5. Connections shall be 1/8-inch female and 1/4-inch male threads for pipe nipple or coupling.
6. Switch shall be diaphragm operated with 3 1/2-inch diaphragm to actuate a single pole double throw snap switch. Diaphragm shall be made of molded Buna-N. Motion of the diaphragm shall be restrained by a calibrated spring that can be adjusted to set the exact pressure differential at which the electrical switch will be actuated. Calibration spring shall be stainless steel. Motion of the diaphragm shall be transmitted to the switch by means of a direct mechanical linkage.
7. Switch housing shall be aluminum die casting with chemical conversion coating for corrosion protection and a zinc plated steel stamping.
8. Manufacturer:
 - a. Dwyer Instruments, Inc., Model 1950-10-2F (for pressure switch).
 - b. Dwyer Instruments, Inc., Model DM-2007-LCD (for differential pressure gage/transmitter).
 - b. Or approved equal.

B. Flow Switch:

1. Flow switch for air service shall be specifically designed for use in an air service application.
2. Flow switch shall be a solid state, thermally activated air flow switch capable of monitoring air flow in fixed ductwork and capable of a switching range between 1 meters/sec. and 10 meters/sec. Switch shall be capable of providing an adjustable switching delay to eliminate the need for circuit logic during turbulent blower startup conditions.
3. Switch housing shall be fabricated of Ultradur material and sample probe shall be ceramic.
4. Switch shall be provided with a mounting flange for installation in the aluminum ductwork assembly as shown on the Drawings.
5. The switch shall have an integral LED light to indicate flow condition in the ductwork.
6. Model and Manufacturer:
 - a. Vent-Captor Model 3201.0 as manufactured by Weber Sensors, Inc.
 - b. Or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine Supports to Receive Blowers for:

1. Proper anchor bolt locations.
2. Unevenness, irregularities and incorrect dimensions.

3.2 MANUFACTURER'S SERVICES

- A. The manufacturer shall certify that the equipment to be furnished meets the general intent of the Specifications and shall list all deviations from the detailed Specifications that exist in the equipment to be furnished.
- B. The manufacturer shall furnish shop drawings, descriptive data, list of installations, and all other information requested by the Engineer.
- C. No equipment shall be manufactured prior to obtaining approval of the shop drawings by the Engineer.
- D. Upon completion of the installation work, the manufacturer shall furnish the Engineer with certification that the equipment has been installed properly.
- E. The manufacturer shall furnish three copies of the instructions for installing, operating, maintaining and lubricating the equipment and a year's supply of lubricants.
- F. The installation of all equipment in this section shall be performed under the direct supervision of the respective equipment manufacturer's field representative.
- G. The equipment manufacturer's representative shall provide a field technician for one day of installation supervision, one day of operator training and 5 days of system startup/shakedown.

3.3 GUARANTEE

- A. The equipment furnished under this Section shall be guaranteed by the manufacturer for a period of one year from the date of final acceptance thereof, against defective materials, designs and workmanship. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced promptly at no expense to the Owner.

+ + END OF SECTION + +

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SECTION 18330

DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work:

1. Under this section, unless otherwise indicated, the Contractor shall furnish all labor, material, and equipment to install ductwork complete with all appurtenances as described herein, and as shown on the drawings and in complete accordance with requirements of all codes and authorities having jurisdiction.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Company shall have minimum three years documented experience specializing in performing the work of this section.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASHRAE - Handbook of Fundamentals; Duct Design.
2. ASHRAE - Handbook of HVAC Systems and Equipment; Duct Construction.
3. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
4. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
5. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
6. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

7. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
8. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.
9. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
10. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
11. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.
12. NFPA 45 - Laboratory Ventilating Systems and Hood Requirements.
13. SMACNA - HVAC Duct Construction Standards.
14. SMACNA - Rectangular Industrial Duct Construction Standards.
15. SMACNA - Round Industrial Duct Construction Standards.
16. SMACNA - HVAC Air Duct Leakage Test Manual.
17. UL 181 - Factory-Made Air Ducts and Connectors.
18. Engineering Design Manual for Air Handling Systems, United McGill Corporation (UMC).
19. Assembly and Installation of Spiral Ducts and Fittings, UMC.
20. Engineering Report No. 132 (Spacing of Duct Hangers), UMC.
21. AWS D1.1 American Welding Society Structural Welding Code.

1.3 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01342.

1. Manufacturer's Catalog Data.
2. Manufacturer's Certifications.
3. Factory Test Results.
4. Field Test Certifications.
5. O&M Manuals.
6. List of previous installations.
7. Warranties.

B. Shop Drawings: Submit for approval the following:

1. Drawings on all items of ductwork, plenums, and casings including construction details and accessories specified herein in accordance with Division 1. Ductwork construction details and materials used for duct sealant, flexible connections, etc. shall be submitted and approved prior to the fabrication of any ductwork.
2. Draw ductwork Shop Drawings on scale building floor plans and indicate duct sizes, material, insulation type, locations of transverse joints, fittings, ductwork bottom elevation, offsets, ductwork specialties, and other information required for coordination with other trades. Clearly designate the following on the Shop Drawings:
 - a. Clearance dimensions between ducts and or location dimensions from walls, floors, columns, beams and large bore piping.
 - b. Duct materials i.e., stainless steel, galvanized steel ductwork pressure class ratings of ducts as defined within this specification.
 - c. Duct materials i.e., stainless steel, galvanized steel.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the Project Site and store and protect products under provisions of Division 1.
- B. Protect materials from rust both before and after installation.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS AND CONSTRUCTION

- A. All ductwork indicated on the Drawings, specified or required for the blower systems shall be of materials as hereinafter specified unless indicated otherwise on Drawings. All air distribution ductwork shall be fabricated, erected, supported, etc., in accordance with all applicable standards of SMACNA where such standards do not conflict with NFPA 90A and where class of construction equals or exceeds that noted herein.
- B. Ductwork shall be constructed of 6061 aluminum.
- C. Minimum gage of round, oval or rectangular ductwork shall be 12 gage.
- D. All duct sizes shown on the Drawings are clear inside dimensions. Allowance shall be made for internal lining, where specified, to provide the required free area.
- E. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for future connections/phases, otherwise plastic covers are acceptable.
- F. Except for specific duct applications specified herein, all sheet metal shall be constructed from 6061 aluminum sheets and/or coils up to 60 inches in width. Each sheet shall be stenciled with manufacturer's name and gage.

- G. Sheet metal must conform to SMACNA sheet metal tolerances as outlined in SMACNA's "HVAC Duct Construction Standards."
- H. Where ducts are exposed to view (including equipment rooms) and where ducts pass through walls, floors or ceilings; furnish and install sheet metal collars around the duct.
- I. Duct joints shall be all soldered construction, one standard gage heavier than for the same size galvanized steel ducts. Refer to SMACNA for equivalent aluminum thickness and reinforcement.
- J. Duct Sealing: All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A, as referenced in SMACNA Standards. All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.
 - 1. All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3 inches wide open weave fiberglass scrim tape. Sufficient additional sealant shall then be applied to completely embed the cloth.
 - 2. Sealant shall be water based latex UL 181A-M sealant with flame spread of 0 and smoke developed of 0. Sealants shall be Hard Cast Iron Grip 601, Ductmate Pro Seal, Foster 32-19, Childers CP-146 or Design Polymerics DP 1010.
 - 3. Scrim tape shall be fiberglass open weave tape, 3 inches wide, with maximum 20/10 thread count, similar to Hardcast FS-150.
 - 4. Sealer shall be rated by the manufacturer and shall be suitable for use at the system pressure classification of applicable ductwork.
 - 5. Except as noted, oil or solvent-based sealants are specifically prohibited.
 - 6. For exterior applications, "Uni-Weather" (United McGill Corporation), solvent-based sealant, or Foster 32-19 shall be used.

2.2 RECTANGULAR AND ROUND DUCTWORK

- A. Metal gages listed in SMACNA HVAC Duct Construction Standards, Metal and Flexible Duct, are the minimum gages which shall be used. Select metal gage heavy enough to withstand the physical abuse of the installation. In no case shall ductwork be less than 12 gage per SMACNA Standards.
- B. All longitudinal seams for rectangular duct shall be selected for the specified material and pressure classification. Seams shall be as referenced in SMACNA Standards.
- C. Longitudinal seams shall be welded.
- D. All transverse joints and intermediate reinforcement on rectangular duct shall be as shown in SMACNA Standards. Transverse joints shall be selected consistent with the specified pressure classification, material, and other provisions for proper assembly of ductwork.
- E. Spiral round duct and fittings shall be as manufactured by United McGill Sheet Metal Company or approved equivalent. All fittings shall be factory fabricated, machine formed and welded from galvanized sheet metal.
- F. Joints in spiral duct and fittings shall be assembled, suspended, sealed, and taped per manufacturer's published assembly and installation instructions.
- G. Contractor may use DUCTMATE or Ward Industries coupling system, as an option, on rectangular ductwork. The DUCTMATE or Ward Industries system shall be installed in strict accordance with manufacturer's recommendations.
- H. Rectangular ductwork field fabricated offsets shall not exceed 30 degrees.

2.3 ELBOWS RECTANGULAR DUCTS

- A. Construct elbows as follows in order of preference:
 - 1. Short radius, single thickness vaned elbows.

2. Rectangular, double thickness vaned elbows.
- B. Short radius elbows shall have a centerline radius of not less than one times the duct width.
- C. Provide turning vanes in all rectangular elbows and offsets.
- D. All turning vanes shall be anchored to the cheeks of the elbow in such a way that the cheeks will not breathe at the surfaces where the vanes touch the cheeks. In most cases, this will necessitate the installation of an angle iron support on the outside of the cheek parallel to the line of the turning vanes.
- E. In 90-degree turns that are over 12 inches wide in the plane of the turn, provide and install double thickness vanes on integral side rails. For ducts under 12 inches in width, use single thickness vanes. The installation of the turning vanes shall be as described for single thickness vanes. On other types of turns or elbows, single thickness trailing edge vanes shall be used.

2.4 DUCT INSULATION

- A. On all building interior ductwork and where called for on the plans the contractor shall provide duct insulation on the exterior of all ductwork.
- B. Insulation shall be provided with a facing material to minimize moisture vapor transmission.
- C. Thermal conductivity of the insulation shall be 0.23 Btu/in at 75°F.
- D. During installation of the insulation, all seams shall be tightly sealed in accordance with manufacturer's recommendation.
- E. Insulation shall be 3" thick and shall be 800 Series SPIN-GLAS Board with All Purpose Facing as manufactured by Johns Manville, or approved equal.

2.5 DUCTWORK LAYOUT

- A. Blower Discharge Ductwork: The blower shall be provided with welded structural grade aluminum transition and discharge duct and a flanged, cloth reinforced neoprene rubber flex connection between the discharge on the blower and the discharge duct to the off-gas treatment system.
- B. Blower Intake Ductwork: A welded, structural grade aluminum transition duct shall be provided between the packed tower ductwork and the blower inlet. A flanged, cloth reinforced neoprene rubber flex connection shall be provided between the packed tower ductwork and the blower inlet.
- C. Tower Discharge Ductwork: A welded, structural grade air duct assembly shall be fabricated to collect exhaust air from the flanged air exhaust outlet near the top of the packed tower and direct the exhaust air to the blower intake ductwork. The dimensions of the ductwork shall be as shown on the Drawings. The ductwork shall be constructed with internal turning vanes at all bends to reduce pressure losses and increase process efficiency. A cloth reinforced neoprene rubber flexible connector shall be provided in the ductwork assembly to allow for adjustment for installation tolerances and to accommodate expansion in the construction materials. The ductwork assembly shall be furnished with flanged ends as required to connect with mating equipment. Fastening hardware shall be Type 304 stainless steel.
- D. Off-Gas Intake Ductwork: A welded, structural grade air duct assembly shall be fabricated to direct exhaust air from the blower outlet to the off-gas treatment system intake. The dimensions of the ductwork shall be as shown on the Drawings. The ductwork shall be constructed with internal turning vanes at all bends to reduce pressure losses and increase process efficiency. A cloth reinforced neoprene rubber flexible connector shall be provided in the ductwork assembly at the off-gas intake to allow for adjustment for installation tolerances and to accommodate expansion in the construction materials. The ductwork assembly shall be furnished with flanged ends as required to connect with mating

equipment. Fastening hardware shall be Type 304 stainless steel.

E. Off-Gas Discharge Ductwork: A welded, structural grade air duct assembly shall be fabricated to direct exhaust air from the off-gas treatment system outlet to the exhaust point at the top of the chimney. The dimensions of the ductwork shall be as shown on the Drawings. The ductwork shall be constructed with internal turning vanes at all bends to reduce pressure losses and increase process efficiency. A cloth reinforced neoprene rubber flexible connector shall be provided in the ductwork assembly at the off-gas discharge and at the top of the chimney to allow for adjustment for installation tolerances and to accommodate expansion in the construction materials. The ductwork assembly will terminate with a bird screen. The ductwork assembly shall be furnished with flanged ends as required to connect with mating equipment. Fastening hardware shall be Type 304 stainless steel.

F. All aluminum duct shall be of welded construction with a minimum thickness of 12 gauge. Duct fabricated with rivets or lock seams will not be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Cleanliness:

1. Before installing ductwork, wipe ductwork to a visibly clean condition.

2. During construction, provide temporary closures of metal or taped polyethylene on open ductwork and duct taps to prevent construction dust or contaminants from entering ductwork system. Seal

- ends of ductwork prior to installation to keep ductwork interior clean. Remove closures only for installation of the next duct section.
3. Disinfect ductwork with a hypochlorite solution following NADCA standards immediately prior to sealing ductwork.
 4. During duration of construction, maintain the integrity of all temporary closures until air systems are activated.
- D. Provide openings in ductwork where required to accommodate thermometers, controllers, flow meters, pressure sensors and other devices. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. All visible welds in ductwork shall be ground and polished.
- G. Slope duct towards a drainage tap for moisture-laden ducts. Provide drain at elbow of main moisture exhaust duct system.
- H. Project inspector shall be notified to inspect all field fabricated offsets before cover-up or external insulation is applied.
- I. Hangers and Supports:
1. All ductwork supports shall be in accordance with Table 4-1 (rectangular duct) and Table 4-2 (round duct) of the SMACNA Standards, with all supports directly anchored to the building structure.
 2. Rectangular duct shall have at least one pair of supports on minimum 8'-0" (eight feet) centers. All horizontal round and flat oval ducts shall have ducts hangers spaced 10'-0" (ten feet) maximum.
 3. Lower attachment of hanger to duct shall be in accordance with Table 4-4 of the SMACNA Standards.

4. Vertical ducts shall be supported where they pass through the floor lines with 1-1/2 inch x 1-1/2 inch x 1/4 inch angles for duct widths up to 60 inches. Above 60 inches in width, the angles must be increased in strength and sized on an individual basis considering space requirements.
5. Hanger straps on duct widths 60 inches and under shall lap under the duct a minimum of 1 inch and have minimum of one fastening screw on the bottom and two on the sides.
6. Hanger straps on duct widths over 60 inches shall be bolted to duct reinforcing with 3/8 inch bolts minimum.

3.2 TESTING

- A. All medium and high pressure duct systems (positive or negative) shall be pressure tested according to SMACNA test procedures (HVAC Air Duct Leakage Test Manual). Notify Owner minimum seven (7) calendar days in advance of leakage testing.
 1. Design pressure for testing ductwork shall be determined from the maximum pressure generated by the fan at the nominal motor horsepower selected.
 2. Total allowable leakage shall not exceed 1 percent of the total system design airflow rate.
 3. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
 4. Leaks identified during leakage testing shall be repaired by:
 - a. Complete removal of the sealing materials.
 - b. Thorough cleaning of the joint surfaces.
 - c. Installation of multiple layers of sealing materials.
 5. The entire ductwork system shall be tested, excluding connections upstream of the terminal

units (i.e. ductwork shall be capped immediately prior to the terminal units, and tested as described above).

6. After testing has proven that ductwork is installed and performs as specified, the terminal units shall be connected to ductwork and connections sealed with extra care. Contractor shall inform the Owner when joints may be visually inspected for voids, splits, or improper sealing of the joints. If any leakage exists in the terminal unit connections/joints after the systems have been put into service, leaks shall be repaired as specified for other leaks.
 7. Fixed flow measurement devices (i.e. orifice tubes, nozzles, etc.) shall have current calibration documentation showing that the device was verified to a National Institute Of Standards and Technology (NIST) standard within the previous five years or as recommended by the manufacture and be accurate to at least $\pm 2\%$ of reading.
 8. Pressure measurement instrumentation (i.e. manometer) shall have current calibration documentation showing that the device was verified to a NIST standard within the previous year or as recommended by the manufacture. Instrumentation shall have an accuracy of at least $\pm 2\%$ of reading and have a resolution of 2:1 with respect to the measured pressure (i.e. resolution of 0.01 measured 0.1).
- B. All low-pressure duct systems (positive or negative) shall be inspected for visible and audible signs of leakage.
1. Leaks identified by inspection shall be repaired by:
 - a. Complete removal of the sealing materials.
 - b. Thorough cleaning of the joint surfaces.
 - c. Installation of multiple layers of sealing materials.

C. Ductwork leakage testing and/or inspection shall be performed prior to installation of external ductwork insulation.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18340

VERTICAL TURBINE BOOSTER PUMP AND MOTOR

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Under this section, the Contractor shall furnish all labor, materials and equipment necessary to furnish and install two multi-stage water lubricated vertical turbine booster pumps and motors in the concrete clearwell of the Aeration Building.
- B. Related Work Specified Elsewhere:
 - 1. Section 18380 - Packed Tower Aeration System Control Panel.
 - 2. Section 18180 - Miscellaneous Appurtenances.

1.2 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01342.
 - 1. Manufacturer's Catalog Data.
 - 2. Design Data.
 - 3. Factory Test Reports.
 - 4. Certified Pump Test Curve.
 - 5. Minimum submergence requirements.
 - 6. Installation Certification.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE PUMP

- A. The booster pumps shall be multi-stage, water lubricated vertical turbine pumps designed for continuous duty and shall include pump head, base plate, electric motor and all necessary appurtenances.

The pump shall conform to ANSI/AWWA E101 latest revision. Pump installation shall conform to the requirements of the Nassau County Department of Health. Pumps shall be Goulds, Layne or approved equal.

- B. The pump shall be suitable for operating within the range of submergence levels indicated on the contract drawings.
- C. The pump shall have a rated capacity of 1,250 gallons per minute when operating at a speed not in excess of 1,780 rpm at a total dynamic head of 230 feet of water. Efficiency at rated point shall not be less than 84.5 percent. Pump shall have four stages.
- D. The pump bowl assembly shall be of standard construction with close-grained enameled cast iron bowls, bronze impellers, renewable bronze wear rings, and stainless steel keyed impeller shaft. All shafts shall be high chromium stainless steel conforming to ASTM Grade 416. Shaft shall be a minimum 1-15/16 inches in diameter. Head shaft shall be two pieces.
- E. The column pipe shall be 10 inch diameter standard black steel pipe with straight and machined ends to butt with the couplings. Column pipe joints shall be coated with an approved sealer.
- F. All pump column and suction pipe surfaces and the exterior surface of pump bowls shall be cleaned by sand blasting. No blasting or surface preparation will be permitted at the project site. The interior and exterior of the suction pipe and pump column and exterior of pump bowls shall be painted with Polyamide-Cured Epoxy Coating. The epoxy coating shall be a two-component, 100% solids, flake-filled high performance epoxy coating. Coating to be Plasite 4500 as manufactured by Carboline Company, applied in one spray coat to a total dry film thickness of 30 mils. Epoxy cure time shall be 5-day minimum at ambient conditions. Coating shall be approved for potable water use by the New York State Department of Health.
- G. The pump head shall be designed to carry the total weight of the complete pump column and shaft assembly as well as properly supporting the electric motor. The pump head shall be provided with an 10-inch flanged

discharge connection. An approved sanitary seal shall be provided where the pump column exits the concrete pad.

H. A stainless steel basket strainer shall be provided on the suction end of the column pipe. The strainer shall have a net inlet area equal to at least four times the suction pipe area. The maximum opening size shall not be more than 75 percent of the minimum opening of the water passage through the bowl or impeller.

I. Motor:

1. The electric motor shall be a premium efficiency vertical hollow shaft continuous duty squirrel cage type and shall comply with ANSI Specifications C50.2 and AWWA E101 latest editions. Motor shall have normal starting torque and low starting current characteristics and shall permit the driven equipment to develop its specified capacity continuously without exceeding the standard temperature rise limits for Class F insulation and shall have a 1.15 service factor.
2. The motors shall be a constant speed, squirrel cage induction type with drip canopy, 100 hp, 460 volt, 60 cycle, 3 phase, 1800 rpm, continuous rating in a 40°C ambient environment. Motors enclosure shall be open drip-proof. The motor shall be rated with a NEMA nominal efficiency of at least 93.6 percent. The motor shall be Type RUS, as manufactured by U.S. Electric Motors, Inc., or approved equal.
3. A motor nameplate shall be securely affixed to the exterior frame indicating as a minimum: voltage, amps, cycles, rpm, hp, NEMA code letter, insulation class, frame number, serial number, and all pertinent information required by NEMA Standards.

J. A pressure gauge and sampling tap shall be furnished and installed on the discharge piping of the pump. Pump discharge gauge shall range from 0 to 200 psi. Gauge shall be as specified in Section 18068 - Small

Diameter Piping, Valves and Specials. Sampling tap shall be 1/4" smooth soft copper as shown on drawings.

K. Anchor Bolts and Base Plate:

1. All anchor bolts and fastenings shall be corrosion resistant and shall resist the pressure due to shutoff head of the pump. Anchor bolts, nuts and washers shall be Type 303, stainless steel, unless otherwise specified, and shall be installed in accordance with the manufacturer's instructions. Anchor bolts shall be set in steel pipe sleeves for the full length of the bolts. Approved special washers and nuts shall be furnished and installed on the lower ends of bolts unless pockets are provided for access to the nuts. Pump base plate shall be grouted to the foundation and shall be sealed airtight.
2. Anchor bolts shall be as specified in Section 05503 - Anchor Bolts, Expansion Anchors and Concrete Inserts.

2.2 FINAL PUMPING TEST

- A. The Contractor shall conduct equipment pumping and efficiency tests after pumps and motors are installed. Water shall be discharged through the blowoff piping. The Contractor shall furnish an orifice plate meter of sufficient capacity to determine the required flow rates. The Contractor shall furnish a calibrated pressure gauge (minimum 4 1/2" diameter) and all required instruments. The Contractor shall direct all water pumped into the blowoff pit on-site by using temporary piping.
- B. Runs shall be conducted at the following rates of discharge: 0, 200, 400, 600, 800, 1,000, 1,200 and 1,300 gpm.
- C. The following data shall be recorded during the tests:
 1. Pumping water level in the clearwell.
 2. Motor voltage, amperage, kilowatts and revolutions per minute.
 3. Pumping flow rate in gpm using orifice plate.

4. Discharge pressure at the centerline of the pump discharge.
- D. All instruments utilized during the tests shall be calibrated by the Contractor and approved by the Engineer, and all testing procedures will be subject to approval by the Engineer.
- E. The results of the test shall be tabulated and submitted to the Engineer in report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

PART 3 - EXECUTION

3.1 GENERAL

- A. At the completion of the pump installation, the Contractor shall furnish and install plugs and caps for all penetrations through the pump head to prevent the migration of pressurized air from the clearwell into the Aeration Building.

3.2 CLEARWELL SAMPLING

- B. The Contractor shall obtain samples of water, 30 minutes after start up of the pump. All samples shall be promptly analyzed at a laboratory approved by the Nassau County Department of Health, and copies of the results shall be promptly submitted to the Engineer. All sampling and analyses shall be conducted in accordance with the current requirements of the New York State and Nassau County Departments of Health, and with the methods set forth in "Standard Methods for the Analysis of Water and Wastewater," latest edition. Analyses of all samples shall include complete Nassau County chemical, physical, heavy metals, volatile halogenated organics, volatile non-halogenated organics, pesticides and herbicides. Analyses shall include all parameters required by the Nassau County Department of Health at the time of the bid. Should the results of the water analyses indicate the presence of contaminants within the well

that were not present prior to the introduction of the coated pumping unit into the clearwell, the Contractor shall, at the direction of the Engineer, remove the pumping unit and remove and reinstall the coating system as required to prevent coating system contaminants from being introduced into the clearwell.

3.3 MANUFACTURER'S CERTIFIED PUMP TEST

- A. Following fabrication of the pump, the manufacturer shall perform a witnessed, certified pumping test of the pump to be delivered to the project.
- B. The certified pump test shall take place in the manufacturer's shop with a testing apparatus designed to supply water to the pump intake and to receive and collect water discharged from the pump assembly. The apparatus shall be capable of throttling the pump, monitoring flow rate and pressure at the pump discharge, and all for speed and load analysis on the pump driver.
- C. The manufacturer shall utilize a standard electric motor of similar horsepower and speed to the motor to be fitted to the pump under the project for the pump test. The manufacturer shall furnish calibrated flow monitoring equipment and pressure and head measuring equipment during the test.
- D. The pump shall be run with the testing apparatus at the following rates of discharge: 0; 200; 400; 600, 800, 1,000, 1,200 and 1,300 gpm.
- E. The following data shall be recorded during the test:
 - 1. Head on the pump intake.
 - 2. Head on the pump discharge.
 - 3. Motor voltage, amperage, kilowatts, and revolutions per minute.
 - 4. Pumping flow rate in gallons per minute.
- F. All instruments utilized during the certified pump test shall be calibrated by the manufacturer and approved by the Engineer, and all testing procedures shall be subject to approval by the Engineer.

- G. The results of the certified pump test shall be tabulated and submitted to the Engineer in a report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a graphical plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

3.4 MANUFACTURER'S SERVICES

- A. Prior to delivery, the manufacturer shall conduct running tests on the assembled pump and submit three copies of performance curves to the Engineer. Test shall conform to ANSI/AWWA E101 latest revision.
- B. Manufacturer's representative shall provide one full day of training instruction to operating personnel in the operation and control of the pump. Training shall conform with the requirements of Section 01730.
- C. Manufacturer shall furnish shop drawings, descriptive data and all other information requested by the Engineer.
- D. After installation by others, the manufacturer shall inspect the installation and furnish the Engineer with certification that the equipment has been installed properly.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18350

VERTICAL TURBINE TRANSFER PUMP AND MOTOR

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Under this section, the Contractor shall furnish all labor, materials and equipment necessary to furnish and install two multi-stage water lubricated vertical turbine transfer pumps and motors in the concrete clearwell of the Aeration Building.
- B. Related Work Specified Elsewhere:
 - 1. Section 18380 - Packed Tower Aeration System Control Panel.
 - 2. Section 18180 - Miscellaneous Appurtenances.

1.2 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01342.
 - 1. Manufacturer's Catalog Data.
 - 2. Design Data.
 - 3. Factory Test Reports.
 - 4. Certified Pump Test Curve.
 - 5. Minimum submergence requirements.
 - 6. Installation Certification.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE PUMP

- A. The transfer pumps shall be multi-stage, water lubricated vertical turbine pumps designed for continuous duty and shall include pump head, base plate, electric motor and all necessary appurtenances.

The pumps shall conform to ANSI/AWWA E101 latest revision. Pump installation shall conform to the requirements of the Nassau County Department of Health. Pumps shall be Goulds, Layne or approved equal.

- B. The pumps shall be suitable for operating within the range of submergence levels indicated on the contract drawings.
- C. The pumps shall have a rated capacity of 1,250 gallons per minute when operating at a speed not in excess of 1,780 rpm at a total dynamic head of 48 feet of water. Efficiency at rated point shall not be less than 84 percent. Pumps shall have one stage.
- D. The pump bowl assembly shall be of standard construction with close-grained enameled cast iron bowls, bronze impellers, renewable bronze wear rings, and stainless steel keyed impeller shaft. All shafts shall be high chromium stainless steel conforming to ASTM Grade 416. Shaft shall be a minimum 1-15/16 inches in diameter. Head shaft shall be two pieces.
- E. The column pipe shall be 10 inch diameter standard black steel pipe with straight and machined ends to butt with the couplings. Column pipe joints shall be coated with an approved sealer.
- F. All pump column and suction pipe surfaces and the exterior surface of pump bowls shall be cleaned by sand blasting. No blasting or surface preparation will be permitted at the project site. The interior and exterior of the suction pipe and pump column and exterior of pump bowls shall be painted with Polyamide-Cured Epoxy Coating. The epoxy coating shall be a two-component, 100% solids, flake-filled high performance epoxy coating. Coating to be Plasite 4500 as manufactured by Carboline Company, applied in one spray coat to a total dry film thickness of 30 mils. Epoxy cure time shall be 5-day minimum at ambient conditions. Coating shall be approved for potable water use by the New York State Department of Health.
- G. The pump head shall be designed to carry the total weight of the complete pump column and shaft assembly as well as properly supporting the electric motor. The pump head shall be provided with an 10-inch flanged

discharge connection. An approved sanitary seal shall be provided where the pump column exits the concrete pad.

H. A stainless steel basket strainer shall be provided on the suction end of the column pipe. The strainer shall have a net inlet area equal to at least four times the suction pipe area. The maximum opening size shall not be more than 75 percent of the minimum opening of the water passage through the bowl or impeller.

I. Motor:

1. The electric motor shall be a premium efficiency vertical hollow shaft continuous duty squirrel cage type and shall comply with ANSI Specifications C50.2 and AWWA E101 latest editions. Motor shall have normal starting torque and low starting current characteristics and shall permit the driven equipment to develop its specified capacity continuously without exceeding the standard temperature rise limits for Class F insulation and shall have a 1.15 service factor.
2. The motors shall be a constant speed, squirrel cage induction type with drip canopy, 20 hp, 460 volt, 60 cycle, 3 phase, 1800 rpm, continuous rating in a 40°C ambient environment. Motors enclosure shall be open drip-proof. The motor shall be rated with a NEMA nominal efficiency of at least 93.6 percent. The motor shall be Type RUS, as manufactured by U.S. Electric Motors, Inc., or approved equal.
3. A motor nameplate shall be securely affixed to the exterior frame indicating as a minimum: voltage, amps, cycles, rpm, hp, NEMA code letter, insulation class, frame number, serial number, and all pertinent information required by NEMA Standards.

J. A pressure gauge and sampling tap shall be furnished and installed on the discharge piping of the pump. Pump discharge gauge shall range from 0 to 200 psi. Gauge shall be as specified in Section 18068 - Small

Diameter Piping, Valves and Specials. Sampling tap shall be 1/4" smooth soft copper as shown on drawings.

K. Anchor Bolts and Base Plate:

1. All anchor bolts and fastenings shall be corrosion resistant and shall resist the pressure due to shutoff head of the pump. Anchor bolts, nuts and washers shall be Type 303, stainless steel, unless otherwise specified, and shall be installed in accordance with the manufacturer's instructions. Anchor bolts shall be set in steel pipe sleeves for the full length of the bolts. Approved special washers and nuts shall be furnished and installed on the lower ends of bolts unless pockets are provided for access to the nuts. Pump base plate shall be grouted to the foundation and shall be sealed airtight.
2. Anchor bolts shall be as specified in Section 05503 - Anchor Bolts, Expansion Anchors and Concrete Inserts.

2.2 FINAL PUMPING TEST

- A. The Contractor shall conduct equipment pumping and efficiency tests after pumps and motors are installed. Water shall be discharged through the blowoff piping. The Contractor shall furnish an orifice plate meter of sufficient capacity to determine the required flow rates. The Contractor shall furnish a calibrated pressure gauge (minimum 4 1/2" diameter) and all required instruments. The Contractor shall direct all water pumped into the blowoff pit on-site by using temporary piping.
- B. Runs shall be conducted at the following rates of discharge: 0, 200, 400, 600, 800, 1,000, 1,200 and 1,300 gpm.
- C. The following data shall be recorded during the tests:
 1. Pumping water level in the clearwell.
 2. Motor voltage, amperage, kilowatts and revolutions per minute.
 3. Pumping flow rate in gpm using orifice plate.

4. Discharge pressure at the centerline of the pump discharge.
- D. All instruments utilized during the tests shall be calibrated by the Contractor and approved by the Engineer, and all testing procedures will be subject to approval by the Engineer.
- E. The results of the test shall be tabulated and submitted to the Engineer in report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

PART 3 - EXECUTION

3.1 GENERAL

- A. At the completion of the pump installation, the Contractor shall furnish and install plugs and caps for all penetrations through the pump head to prevent the migration of pressurized air from the clearwell into the Aeration Building.

3.2 CLEARWELL SAMPLING

- B. The Contractor shall obtain samples of water, 30 minutes after start up of the pump. All samples shall be promptly analyzed at a laboratory approved by the Nassau County Department of Health, and copies of the results shall be promptly submitted to the Engineer. All sampling and analyses shall be conducted in accordance with the current requirements of the New York State and Nassau County Departments of Health, and with the methods set forth in "Standard Methods for the Analysis of Water and Wastewater," latest edition. Analyses of all samples shall include complete Nassau County chemical, physical, heavy metals, volatile halogenated organics, volatile non-halogenated organics, pesticides and herbicides. Analyses shall include all parameters required by the Nassau County Department of Health at the time of the bid. Should the results of the water analyses indicate the presence of contaminants within the well

that were not present prior to the introduction of the coated pumping unit into the clearwell, the Contractor shall, at the direction of the Engineer, remove the pumping unit and remove and reinstall the coating system as required to prevent coating system contaminants from being introduced into the clearwell.

3.3 MANUFACTURER'S CERTIFIED PUMP TEST

- A. Following fabrication of the pump, the manufacturer shall perform a witnessed, certified pumping test of the pump to be delivered to the project.
- B. The certified pump test shall take place in the manufacturer's shop with a testing apparatus designed to supply water to the pump intake and to receive and collect water discharged from the pump assembly. The apparatus shall be capable of throttling the pump, monitoring flow rate and pressure at the pump discharge, and all for speed and load analysis on the pump driver.
- C. The manufacturer shall utilize a standard electric motor of similar horsepower and speed to the motor to be fitted to the pump under the project for the pump test. The manufacturer shall furnish calibrated flow monitoring equipment and pressure and head measuring equipment during the test.
- D. The pump shall be run with the testing apparatus at the following rates of discharge: 0; 200; 400; 600, 800, 1,000, 1,200 and 1,300 gpm.
- E. The following data shall be recorded during the test:
 - 1. Head on the pump intake.
 - 2. Head on the pump discharge.
 - 3. Motor voltage, amperage, kilowatts, and revolutions per minute.
 - 4. Pumping flow rate in gallons per minute.
- F. All instruments utilized during the certified pump test shall be calibrated by the manufacturer and approved by the Engineer, and all testing procedures shall be subject to approval by the Engineer.

- G. The results of the certified pump test shall be tabulated and submitted to the Engineer in a report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a graphical plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

3.4 MANUFACTURER'S SERVICES

- A. Prior to delivery, the manufacturer shall conduct running tests on the assembled pump and submit three copies of performance curves to the Engineer. Test shall conform to ANSI/AWWA E101 latest revision.
- B. Manufacturer's representative shall provide one full day of training instruction to operating personnel in the operation and control of the pump. Training shall conform with the requirements of Section 01730.
- C. Manufacturer shall furnish shop drawings, descriptive data and all other information requested by the Engineer.
- D. After installation by others, the manufacturer shall inspect the installation and furnish the Engineer with certification that the equipment has been installed properly.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18360

VERTICAL TURBINE DEEP WELL PUMP AND MOTOR

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Under this section, the Contractor shall furnish all labor, materials and equipment necessary to perform a preliminary pump test on Wells No. 7A and 8A, remove the existing vertical turbine pump, pump heads and motors from Wells No. 7A and 8A, and furnish and install a water lubricated vertical turbine pump and motor in the existing Wells No. 7A and 8A well casing, disinfect the pumps and wells, and perform a final pumping test on each well.
- B. Related Work Specified Elsewhere:
 - 1. Section 18180 - Miscellaneous Appurtenances.
 - 2. Section 18380 - Packed Tower Aeration System Control Panel.

1.2 EXISTING EQUIPMENT

- A. The existing well are equipped with 100-HP, 1770-rpm, U.S. Motors and Johnson pump heads. The Contractor shall remove the motors and well pumps from each existing well head, and deliver the motor to the Owner. Well 7A is equipped with an American Marsh, 5-stage, 1770-rpm, 12 DC deep well turbine pump, 125 feet of 10-inch column pipe, and a 10-foot section of 10-inch suction pipe. Well 8A is equipped with a Johnson 5-stage, 1770-rpm, 12 CS deep well turbine pump, 95 feet of 10-inch column pipe, and a 10-foot section of 10-inch suction pipe. The well pump, well pump discharge head, column, and shaft shall be removed and disposed of by the Contractor.
- B. The Contractor shall reinstall a new pump head on the existing pump foundation. A New York State Department of Health approved sanitary well seal shall be furnished and installed at the pump head. The Contractor shall furnish and install all equipment, anchoring devices, and make any modifications

necessary to mount the new pump head on the existing pump foundation and reconnect the pump head to the existing discharge piping.

1.3 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01342.
 - 1. Manufacturer's Catalog Data for pump, pumping equipment and motor.
 - 2. Pump design Data.
 - 3. Factory Test Reports.
 - 4. Certified Pump Test Curve.
 - 5. Minimum submergence requirements.
 - 6. Installation Certification for pump and motor.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE PUMP

- A. Each pump shall be a multi-stage water lubricated vertical turbine pump designed for continuous duty and shall include column piping, pump shaft, suction pipe, electric motor and all necessary appurtenances. Pumps shall conform to ANSI/AWWA E101 latest revision. Pump installation shall conform to the requirements of the Nassau County Department of Health. Pump shall be Peabody Floway, Goulds, Peerless, Johnston or approved equal.
- B. Contractor shall furnish and install 125 feet of 10-inch diameter column pipe for Well 7A, and 125 feet of 10-inch diameter column pipe for Well 8A. Column pipe shall be black steel, ASTM A120-57T with straight, machined, threaded ends and connected with couplings. Column pipe shall be standard weight steel with a minimum wall thickness of 0.27-inch and a minimum weight of 31.20 pounds per foot.
- C. The pumps shall each have a rated capacity of 1,200 gallons per minute when operating at a speed not in

excess of 1780 rpm at a total dynamic head of 135 feet of water. Efficiency at rated point shall not be less than 83.9 percent. Pumps shall each have 3 stages. The final pump design point shall be determined by the Engineer, based upon the results of the preliminary pump test. (Refer to Part 3.)

- D. The pump bowl assemblies shall be of standard construction with close-grained enameled cast iron bowls, bronze impellers, renewable bronze wear rings, and stainless steel keyed impeller shaft. All shafts shall be high chromium stainless steel conforming to ASTM Grade 416. Shafts shall be a minimum 1-15/16 inches in diameter. Head shaft shall be two pieces with a coupling above the stuffing box.
- E. Pump shaft shall be made in sections 10 feet long, adequately supported by rubber bearings and alignment spiders. Top of pump bowls shall be set at least 25 feet below pumping level of the water when Wells 7A and 8A are each delivering 1,200 gpm and pumping level in the wells has become stationary. There shall be at least 10 feet of suction pipe below the pump without strainer or flare. Impellers shall be the enclosed type and made of bronze (ASTM B584, Alloy C83800). The units shall hang in center of well casing with sufficient clearance so that they will not contact the casing under any condition of operation. Impellers shall have renewable bronze wear rings. Bowl assemblies shall be of enameled high strength cast iron.
- F. A 10-foot length of 10-inch diameter black steel suction pipe shall be furnished and installed at the suction end of each bowl assembly.
- G. All pump column and suction pipe surfaces and the exterior surface of pump bowls shall be cleaned by sand blasting. No blasting or surface preparation will be permitted at the project site. The interior and exterior of the suction pipe and pump column and exterior of pump bowls shall be painted with Polyamide-Cured Epoxy Coating. The epoxy coating shall be a two-component, 100% solids, flake-filled high performance epoxy coating. Coating to be Plasite 4500 as manufactured by Carboline Company, applied in one spray coat to a total dry film thickness of 30 mils. Epoxy cure time shall be 5-day minimum at ambient

conditions. Coating shall be approved for potable water use by the New York State Department of Health.

- H. Each pump shall be supplied with a cast iron, ASTM A48 Class 30 surface discharge head having a 10-inch diameter flanged discharge opening with discharge flange drilled to ANSI standards for 125 pound rating. Each head shall include prelube connection to wet the line shaft bearings adequately. Each discharge head shall be suitable for mounting the electric motor. Base plate shall have tapped holes for stud bolts to fasten discharge head to base plate and shall have drilled holes for anchor bolts to fasten base plate to concrete foundation.
- I. Each pump head shall have a shaft packing box and a renewable bronze bushing. The packing gland shall be of bronze ASTM B505, Alloy C83800, with stainless steel bolting and stainless steel adjusting nuts. Sealing between the stuffing box and the discharge head shall be accomplished by means of an "O" ring.
- J. Each pump head shall have a one inch diameter hole so located that a tape or electric sounder may be used to accurately measure down to level of water in well at all times. Hole shall be closed by a removable threaded plug, or nipple with cap. Pump head shall have taps for two air lines. A quick coupling compression fitting as manufactured by Evertite, or approved equal shall be provided to form a watertight seal where air lines pass through the pump head.
- K. The Contractor shall furnish and install a sampling tap and pressure gauge on each well pump discharge as shown on the Drawings. Pump discharge gauge shall range from 0 to 200 psi. Gauge shall be as specified in Section 18068 - Small Diameter Piping, Valves and Specials. Sampling tap shall be 1/4-inch smooth copper pipe as shown on drawings.

- L. Anchor Bolts and Base Plate: All fastenings shall be corrosion resistant and shall resist the pressure due to shutoff head of the pump. Anchor bolts, nuts and washers shall be Type 303, stainless steel, unless otherwise specified, and shall be installed in accordance with the manufacturer's instructions. Approved special washers and nuts shall be furnished and installed on the lower ends of bolts unless pockets are provided for access to the nuts. Pump base plate shall be grouted to the foundation and shall be sealed airtight.

2.2 ELECTRIC MOTOR

- A. Each electric motor shall be a vertical hollow shaft, premium efficiency continuous duty squirrel cage type and shall comply with ANSI Specifications C50.2 and AWWA E101 latest editions. Motor shall have normal starting torque and low starting current characteristics and shall permit the driven equipment to develop its specified capacity continuously without exceeding the standard temperature rise limits for Class F insulation and shall have a 1.15 service factor. NEMA nominal efficiency shall be 94.5%
- B. Each motor shall be a constant speed, squirrel cage induction type with drip canopy, 50 hp, 460 volt, 60 cycle, 3 phase, 1,800 rpm, continuous rating in a 40°C ambient. Motor enclosure shall be weather protected Type I. The motors shall be type RUS, as manufactured by U.S. Electric Motors, Inc. or approved equal.
- C. Each motor shall be provided with a non-reverse mechanism to protect the line shaft bearings from reverse rotation when the power is interrupted and the water empties from the discharge column. A thrust bearing of ample capacity to carry a maximum down thrust of 8,000 pounds shall be incorporated in the motor as an integral part of it. Provisions shall be made for momentary upthrust equal to 30% of rated down thrust. The bearings shall be of such size that the average life rating is no less than 5 years continuous operation. Motor shall be suitable for mounting to well pump discharge head. Manufacturer shall provide all accessories necessary for connection to deep well turbine pump and surface discharge head.

- D. A motor nameplate shall be securely affixed to exterior frame indicating as a minimum: voltage, amps, cycles, rpm, hp, NEMA code letter, insulation class, frame number, serial number and all pertinent information required by NEMA Standards.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall take all precautions necessary, or as may be required, to permanently prevent contaminated water or water having undesirable physical or chemical characteristics from entering the well. The Contractor shall also take all necessary precautions during the construction period to prevent any contaminant from entering the well, either through the opening or seepage through the ground surface.
- B. The Contractor shall protect all items used during the construction operations against contamination by thoroughly chlorinating the equipment and materials.

3.2 PRELIMINARY PUMPING TEST

- A. Prior to the removal of the existing well pumps and motor, the Contractor shall conduct a preliminary pumping and efficiency test on each well. Water shall be discharged through the blowoff piping assembly located adjacent to the existing well station or through temporary piping provided by Contractor and shall be directed with temporary piping provided by the Contractor to the nearest acceptable storm drain, or approved disposal location. Contractor shall furnish calibrated pressure gauges (minimum 4 1/2-inch diameter), a temporary orifice plate flow meter, diffuser, dechlorination equipment, chemicals and all required instruments.
- B. Pump test runs shall be conducted at the following rates of discharge: 0, 200, 400, 600, 800, 1,000, 1,200 and 1,300 gpm. Readings for a run shall not be taken until the static water level, flow rate and drawdown have stabilized.

- C. The following data shall be recorded during the test:
1. Static water level below base plate of pump (prior to start of test).
 2. Pumping water level below base plate of pump (at each test point).
 3. Motor voltage, amperage, kilowatts and revolutions per minute (at each test point).
 4. Pumping flow rate in gpm using orifice plate (at each test point).
 5. Discharge pressure at the centerline of the pump discharge (at each test point).
- D. All instruments utilized during the tests shall be calibrated by the Contractor and approved by the Engineer, and all testing procedures will be subject to approval by the Engineer.
- E. The results of the tests shall be tabulated and submitted to the Engineer in report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a plot of flow in gallons per minute versus total dynamic head in feet, calculated well specific capacity, and a plot of flow in gallons per minute versus wire to water efficiency.

3.3 MANUFACTURER'S CERTIFIED PUMP TEST

- A. Following fabrication of each pump, the manufacturer shall perform a witnessed, certified pumping test of the pump to be delivered to the project.
- B. The certified pump test shall take place in the manufacturer's shop with a testing apparatus designed to supply water to the pump intake and to receive and collect water discharged from the pump assembly. The apparatus shall be capable of throttling the pump, monitoring flow rate and pressure at the pump discharge, and all for speed and load analysis on the pump driver.
- C. The manufacturer shall utilize a standard electric motor of similar horsepower and speed to the motor to

be fitted to the pump under the project for the pump test. The manufacturer shall furnish calibrated flow monitoring equipment and pressure and head measuring equipment during the test.

- D. The pump shall be run with the testing apparatus at the following rates of discharge: 0, 200, 400, 600, 800, 1,000, 1,200 and 1,300 gpm
- E. The following data shall be recorded during the test:
 - 1. Head on the pump intake.
 - 2. Head on the pump discharge.
 - 3. Motor voltage, amperage, kilowatts, and revolutions per minute.
 - 4. Pumping flow rate in gallons per minute.
- F. All instruments utilized during the certified pump test shall be calibrated by the manufacturer and approved by the Engineer, and all testing procedures shall be subject to approval by the Engineer.
- G. The results of the certified pump test shall be tabulated and submitted to the Engineer in a report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a graphical plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

3.4 PUMP INSTALLATION AND DISINFECTION

- A. The Contractor shall assemble each pumping unit, install it in the well, install the new motors, install the new discharge heads, and connect the discharge piping, water prelube piping, and electric wiring. All nuts and bolts shall be new and of the same material as those replaced.
- B. All threads on the column pipe shall be cleaned and coated with an approved non-toxic compound which does not provide an environment conducive to the harboring or growth of bacteria. All column and shafting shall be perfectly aligned with all butting faces square to the central axis of the shaft. The pump shall be hung

true and vertical in the well and if necessary the pump base plate shall be shimmed and regouted. The pump head shall be provided with a sanitary seal approved by the Nassau County Department of Health.

- C. After complete reinstallation, the Contractor shall make all necessary adjustments to the impellers by means of the adjustment nut on top of the motor. The Contractor shall eliminate any vibrations, imbalance, binding or other defect in the pumping unit.
- D. The Contractor shall furnish and install two new 1/4" I.D. non-toxic polyethylene air lines in each well from two feet above the bottom of the suction pipe to the pump discharge head. One air line shall be kept as a spare and the other shall be connected to a gauge on the discharge head. The contractor shall furnish and install a new draw down gauge. The tubing shall be strapped to the discharge column with stainless steel wire or banding. All measurements of the location and length of the tubing shall be carefully taken and recorded by the Contractor. A quick coupling compression fitting as manufactured by Evertite or approved equal shall be provided to form a watertight seal where air lines pass through the pump head. The Contractor shall provide a hand air pump suitable for the application.
- E. Disinfection and Sampling:
 - 1. The Contractor shall disinfect each well before water is pumped into the system. The water shall meet the sanitary requirements of the New York State Department of Health.
 - 2. Disinfection shall be accomplished in accordance with AWWA Specification C654 latest edition. The well shall be chlorinated to provide a chlorine residual of approximately 50 mg/l in the water within the casing, circulated within the casing and pump column and pumped to waste until zero chlorine residual is measured.
 - 3. After continued pumping to waste for a minimum of 15 minutes, the well shall be shut off and the well and pumping equipment shall be left to stand for 24 hours prior to the collection of

bacteriological samples. At the time of bacteriological sampling, the water shall have a total chlorine residual of less than 0.05 mg/l.

4. The Contractor shall have a laboratory approved by the Department of Health collect and analyze water samples for bacterial quality upon start up of pump, and 2, 5, 10, 15 and 30 minutes after start up. The water pumped from the well during disinfection shall be disposed of by the Contractor in a manner approved by the Engineer.
5. Water pumped from the well shall be conducted at the Contractor's expense to a place where it will be possible to dispose of the water without damage to property or creation of a nuisance.
6. All samples shall be analyzed, and disinfection shall be continued until all results are acceptable. The Engineer and Department of Health shall be furnished a copy of the laboratory reports. The Contractor shall inform the Department of Health when the well is ready for sampling.
7. The Nassau County Health Department (NCHD) will take additional samples after acceptable bacteriological samples are obtained by the Contractor. The Contractor shall rechlorinate the well and reanalyze as necessary until two consecutive approved bacteriological samples taken at 24-hour intervals are obtained by both the Contractor and the NCDH and the results are acceptable to the NCDH.
8. In addition to the above bacteriological series test, the Contractor shall obtain samples of water, 2 minutes after start up of the pump and analyzed for Principal Organic Contaminants (POCs) and Inorganics (IOCs) in accordance with current Nassau County Department of Health requirements. All samples shall be promptly analyzed at a laboratory approved by the Nassau County Department of Health, and copies of the results shall be promptly submitted to the Engineer. All sampling and analyses shall be conducted in accordance with the current requirements of the New York State and Nassau

County Departments of Health, and with the methods set forth in "Standard Methods for the Analysis of Water and Wastewater," latest edition. Analyses of all samples shall include complete Nassau County chemical, physical, heavy metals, volatile halogenated organics, volatile non-halogenated organics, pesticides and herbicides. Analyses shall include all parameters required by the Nassau County Department of Health. Should the results of the water analyses indicate the presence of contaminants within the well that were not present prior to the introduction of the coated pumping unit into the well, the Contractor shall, at the direction of the Engineer, remove the pumping unit, and remove and reinstall the coating system as required to prevent coating system contaminants from being introduced into the well.

3.5 FINAL PUMPING TEST

- A. The Contractor shall conduct equipment pumping and efficiency tests when the new pumps and motors are installed. Water shall be discharged through temporary piping provided by Contractor to the nearest acceptable storm drain. Contractor shall furnish calibrated pressure gauge (minimum 4 1/2-inch diameter) and all required instruments.
- B. Runs shall be conducted at the following rates of discharge: 0, 200, 400, 600, 800, 1,000, 1,200 and 1,300 gpm. Readings for a run shall not be taken until the static water level, flow rate and drawdown have stabilized.
- C. The following data shall be recorded during the tests:
 - 1. Static water level below base plate of pump (prior to start of test).
 - 2. Pumping water level below base plate of pump (at each test point).
 - 3. Motor voltage, amperage, kilowatts and revolutions per minute (at each test point).
 - 4. Pumping flow rate in gpm using orifice plate (at each test point).

5. Discharge pressure at the centerline of the pump discharge (at each test point).
- D. All instruments utilized during the tests shall be calibrated by the Contractor and approved by the Engineer, and all testing procedures will be subject to approval by the Engineer.
- E. The results of the tests shall be tabulated and submitted to the Engineer in report form. The wire to water efficiency shall be calculated for all runs. The report shall include, for each test, a plot of flow in gallons per minute versus total dynamic head in feet and a plot of flow in gallons per minute versus wire to water efficiency.

3.6 MANUFACTURER'S SERVICES

- A. Prior to delivery, the manufacturer shall conduct certified pumping tests on the assembled pumps with the actual motor to be provided and submit three copies of performance curves to the Engineer. Test shall conform to ANSI/AWWA E101 latest revision.
- B. Manufacturer's representative shall provide one full day of training instruction to operating personnel in the operation and control of the pump. Training shall conform with the requirements of Section 01730.
- C. Manufacturer shall furnish shop drawings, descriptive data and all other information requested by the Engineer.
- D. Following installation of the pumping equipment, the Contractor shall furnish the Engineer with a pump installation report, indicating at a minimum, materials and dimensions of all equipment installed, pump, column and suction settings, certified pump curves and final pump results.
- E. After installation by others, the manufacturer shall inspect the installation and furnish the Engineer with certification that the equipment has been installed properly.

+ + END OF SECTION + +

SECTION 18380

PACKED TOWER AERATION SYSTEM CONTROL PANEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Under this Section, the Plumbing Contractor shall furnish a packed tower aeration system control panel, and furnish and install a clearwell level pressure transducer and appurtenances as shown on the Contract Drawings, specified herein or required for a complete installation.
2. The Plumbing Contractor shall furnish the control panel. Wiring of the panel power, control and instrumentation wiring shall be performed by the Electrical Contractor.
3. The control logic shall be as described herein.
4. The Contractor is responsible to ensure that the controls are completely compatible and configured for use with the equipment supplied and shall furnish documentation so stated.
5. The Packed Tower Aeration System Control Panel shall consist of relay based logic with an operator interface and PLC for adjustment of pressure transducer clearwell level (low, high) set points and tower airflow monitoring and adjustment of low tower airflow alarm set point. The packed tower aeration system control panel shall be capable of operating on clearwell float switches and air flow switch using relay logic should the PLC fail.
6. The Packed Tower Aeration System Control Panel shall act as the RTU in the Packed Tower Building and shall accept I/O in accordance with the SCADA I/O List in Specification Section 18420.
7. The Packed Tower Aeration System Control Panel shall be capable of operating if the SCADA RTU in the Well Building is not in service. Note that we

understand the "Well Call" command from SCADA will not be available.

B. Related Work Specified Elsewhere:

1. General and Special Conditions.
2. Division 1, General Requirements.
3. Section 18300, Packed Tower Aeration System.
4. Section 18320, Centrifugal Blower.
5. Section 18340, Vertical Turbine Booster Pump and Motor.
6. Section 18350, Vertical Turbine Transfer Pump and Motor.
7. Section 18360, Vertical Turbine Deep Well Pump and Motor.
8. Section 18180, Miscellaneous Appurtenances (for float switches).
9. Section 18440, Well Blowoff Valve Control Panels.
10. Division 16, Electrical, including wiring diagrams detailing interconnections with motor control center and well pump motor starter.

1.2 QUALITY ASSURANCE

A. System Supplier:

1. In order to insure standardization, proper interfacing and compatibility, it is required by the Engineer that all equipment offered under this Section, be furnished by a single system supplier who shall furnish and install all equipment and start-up services required for a proper installation, including coordination of all shop drawings. This system supplier shall be retained by the Contractor as a sub-contractor.
2. The system supplier shall have and maintain an adequate service organization or service representatives located within 100 miles of the project site and shall be fully knowledgeable in the operation, maintenance and installation of

equipment required with a minimum 10 years applicable experience.

3. All reference to model numbers and other pertinent information herein is intended to establish the standards of performance, quality and appearance, and is based upon equipment already designed and manufactured.
4. Any system proposed as equal to that herein specified shall be proven to be such by the Contractor. The Contractor shall obtain the Engineer's approval in writing prior to substitution of materials as specified.
5. System supplier shall be:

Eagle Control Corp., Yaphank, Long Island (Mr. Chuck Zahradka, telephone number (631) 924-1315), or approved equal.

B. Referenced Standards: The Contractor shall comply with applicable provisions and recommendations of the following:

1. National Electrical Code
2. Underwriters Laboratories, Incorporated
3. Factory Mutual
4. National Electrical Manufacturer's Association
5. Occupational Safety and Health Act

1.3 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted for approval prior to fabrication in accordance with the Special Conditions of these specifications.
2. Shop drawings shall include physical arrangement of the control panel, internal details, wiring diagrams, control schematics, description of components and nameplate schedule. Include modifications to existing well controls.

3. Complete point-to-point wiring diagrams shall be provided.
 4. Control schematics shall be referenced to a detailed written description of the functions of all switches and relays. Wiring diagrams will not be reviewed without this detailed functional description. Descriptions shall include, as applicable, but shall not be limited to the following:
 - a. Operation of system controls.
 - b. Descriptions shall be complete and shall be the basis of instruction for operating and maintenance personnel.
 5. The Contractor shall submit a certification executed by the control system manufacturer stating that the packed tower aeration system (blowers, booster pumps, transfer pumps, well pumps, and appurtenances) and controls are totally compatible.
 6. Submit operations and maintenance manuals in accordance with the Special Conditions.
- B. Test Procedures:
1. Factory test procedure shall be submitted for approval. Include all methods and equipment.

1.4 GENERAL

- A. Material: All electrical components and materials supplied shall function as a complete unit to automatically control the packed tower aeration system. All devices and material shall be new and of standard product design.
- B. UL Label: The control panel enclosure shall be in accordance with Underwriters Laboratories and must bear the manufacturer's UL label for enclosures to indicate and qualify same.
- C. The control panel assembly and wiring shall be constructed in accordance with Underwriters Laboratories UL508. All components used in the panel shall be Underwriters Laboratories approved for the application. Electrical work shall be in accordance

with the latest edition of the National Electrical Code and all local codes.

- D. **Manufacturer Nameplate:** There shall be permanently affixed to the inside of the exterior enclosure door a nameplate indicating the order reference number, date manufactured and the control panel manufacturer's name, address and telephone number.
- E. **Wiring:** All power wire shall be stranded and sized as required for load and application according to the NEC. All control and signal wire shall be a minimum of #14 AWG, 90 degree insulated and color coded. Colors shall be red for all AC control, yellow for external source control, white for AC neutral and green for equipment ground wiring. All wiring on the rear of the inner door shall be neatly bundled using tie wraps or other means. All internal wiring on the backplate shall be neatly routed in wire duct with removable covers. All wiring shall be continuous point to point (no splices) and be totally accessible with permanent number marking on each end to match the control schematic drawings.
- F. **Quality Control and Testing:** The panel shall be manufactured using quality workmanship and components. Upon completion of the panel it shall be completely factory tested. All control and alarm operations shall be performed with external signals simulated to ensure proper sequencing and operation. Submit certified test reports to the Engineer prior to shipment. The line voltage for which the panel is intended shall be used for testing.

PART 2 - MATERIALS

2.1 DESCRIPTION OF SYSTEM OPERATION

A. System Overview

- 1. The control panel shall provide logic to control the well pumps, blowers, transfer pumps, booster pumps and appurtenances as described herein. The panel shall operate on a 30 amp, 120 volt, 1 phase power supply.
- 2. The well pump motor starters are existing and are located in the Wells 7A and 8A Building. The motor starters for the blowers, transfer pumps and

booster pumps will be furnished in the motor control center located in the Aeration Building.

3. The control panel shall contain the following switches:
 - a. Blower 1 Hand-Off-Auto Switch
 - b. Blower 2 Hand-Off-Auto Switch
 - c. Transfer Pump 1 Hand-Off-Auto Switch
 - d. Transfer Pump 2 Hand-Off-Auto Switch
 - e. Transfer Pump Control Mode Switch (Float Switch Operation-Pressure Transducer Operation)
 - f. Booster Pump 1 Hand-Off-Auto Switch
 - g. Booster Pump 2 Hand-Off-Auto Switch
 - h. Booster Pump Control Mode Switch (Float Switch Operation-Pressure Transducer Operation)
 - i. Low Air Flow Control Mode Switch (Operator Interface-Flow Switch Operation)
 - j. Well Pump 7A Hand-Off-Auto Switch
 - k. Well Pump 8A Hand-Off-Auto Switch
 - l. Well 7A Blowoff Valve Open-Close-Auto Switch
 - m. Well 8A Blowoff Valve Open-Close-Auto Switch
 - n. Push to test button for low air flow (opens device circuit)
 - o. Push to test button for low air pressure device (opens device circuit)
 - p. Push to test button for blower 1 motor starter relay (opens device circuit)
 - q. Push to test button for blower 2 motor starter relay (opens device circuit)
 - r. Reset pushbutton for alarm conditions (clearwell 1 high-high level, clearwell 1

low-low level, blower 1 low air flow, blower 2 low air pressure)

- s. Reset pushbutton for alarm conditions (clearwell 2 high-high level, clearwell 2 low-low level, blower 2 low air flow, blower 2 low air pressure)
- t. Transfer pump 1-2/2-1 lead-lag switch
- u. Booster pump 1-2/2-1 lead-lag switch
- v. Well pump 7A-8A/8A-7A lead-lag switch

4. The control panel shall contain the following indicators:

- a. Blower 1 Low Pressure Alarm Pilot Light
- b. Blower 2 Low Pressure Alarm Pilot Light
- c. Blower 1 Low Air Flow Alarm Pilot Light
- d. Blower 2 Low Air Flow Alarm Pilot Light
- e. Blower 1 Motor Starter Relay Fault Alarm Light
- f. Blower 2 Motor Starter Relay Fault Alarm Light
- g. Blower 1 Running Unloaded Alarm Pilot Light
- h. Blower 2 Running Unloaded Alarm Pilot Light
- i. Call for Blower 1 Pilot Light
- j. Call for Blower 2 Pilot Light
- k. Blower 1 Safeties Satisfied Pilot Light
- l. Blower 2 Safeties Satisfied Pilot Light
- m. Blower 1 Safeties Not Satisfied Pilot Light
- n. Blower 2 Safeties Not Satisfied Pilot Light
- o. Blower 1 Running Pilot Light
- p. Blower 2 Running Pilot Light

- q. Blower 1 Running Elapsed Time Meter
- r. Blower 2 Running Elapsed Time Meter
- s. Call for Well Pump 7A Pilot Light
- t. Call for Well Pump 8A Pilot Light
- u. Well Pump 7A Running Pilot Light
- v. Well Pump 8A Running Pilot Light
- w. Well Pump 7A Prelube/Blowoff Sequence Pilot Light
- x. Well Pump 8A Prelube/Blowoff Sequence Pilot Light
- y. Well Pump 7A Backspin Timer Light
- z. Well Pump 8A Backspin Timer Light
- aa. Well Pump 7A Blowoff Valve Open Pilot Light
- bb. Well Pump 8A Blowoff Valve Open Pilot Light
- cc. Well Pump 7A Blowoff Valve Closed Pilot Light
- dd. Well Pump 8A Blowoff Valve Closed Pilot Light
- ee. Well Pump 7A Discharge Valve Open Pilot Light
- ff. Well Pump 8A Discharge Valve Open Pilot Light
- gg. Well Pump 7A Discharge Valve Closed Pilot Light
- hh. Well Pump 8A Discharge Valve Closed Pilot Light
- ii. Well Pump 7A Blowoff Sequence Trouble Pilot Light
- jj. Well Pump 8A Blowoff Sequence Trouble Pilot Light
- kk. Well Pump 7A Off Pilot Light
- ll. Well Pump 8A Off Pilot Light
- mm. Call for Transfer Pump 1 Pilot Light

nn. Call for Transfer Pump 2 Pilot Light
oo. Transfer Pump 1 Running Pilot Light
pp. Transfer Pump 2 Running Pilot Light
qq. Transfer Pump 1 Off Pilot Light
rr. Transfer Pump 2 Off Pilot Light
ss. Call for Booster Pump 1 Pilot Light
tt. Call for Booster Pump 2 Pilot Light
uu. Booster Pump 1 Running Pilot Light
vv. Booster Pump 2 Running Pilot Light
ww. Booster Pump 1 Off Pilot Light
xx. Booster Pump 2 Off Pilot Light
yy. High-High Clearwell 1 Level Alarm Pilot Light
(Via Float Switch)
zz. High-High Clearwell 2 Level Alarm Pilot Light
(Via Float Switch)
aaa. Clearwell 1 Level Normal Pilot Light
bbb. Clearwell 2 Level Normal Pilot Light
ccc. Report Back - Well 7A Pump Chemical Safeties
Satisfied
ddd. Report Back - Well 8A Pump Chemical Safeties
Satisfied
eee. Report Back - Booster 1 Chemical Safeties
Satisfied
fff. Report Back - Booster 2 Chemical Safeties
Satisfied
ggg. Well 7A Flow (via SCADA RTU)
hhh. Well 8A Flow (via SCADA RTU)
iii. Booster Flow

5. The control panel shall contain a PLC driven operator interface with navigation controls and numeric keypad for adjusting pressure transducer level setpoints, for indicating tower air flow and for adjusting tower low air flow setpoint. The operator interface shall accept 4-20mA input signals from the clearwell level pressure transducers and air flow pressure transmitters and provide calibrated indication of clearwell level and setpoint locations (in feet above the clearwell bottom slab elevation), and air flow volumes (in cubic feet per minute). Setpoints shall be adjustable through either the local keypad or the remote SCADA system connection.

B. Description of Controls:

1. Blower 1 and Well Pump Operation:

- a. The blower 1 motor shall be controlled by a Hand-Off-Auto switch. In the "Off" position, the blower motor shall not operate. In the "Hand" position, the blower motor shall run. In the "Auto" position, the blower shall start upon the call for the well pump to operate.
- b. When the well pump is in the "Auto" mode, it shall start pumping to blowoff when the well is called to operate. After the blowoff cycle is complete, the discharge valve shall be called to open.
- c. In automatic mode, once the blower starts, the blower has its own set of five safeties (suction air flow switch, discharge air flow switch, pressure switch, blower motor starter auxiliary contact and blower "motor running loaded" contact [from blower motor starter compartment]), which must be satisfied before the well pump shall be permitted to pump to the packed tower. In addition, for the well pump to operate the water level in Clearwell 1 must be below the high-high float switch setting. Furnish and install a normally open dry contact (close for well pump operation) for connection to the control circuit in the well pump motor starter.

- d. The air flow switches, air flow transmitter and pressure switch safeties shall initiate timers (adjustable 0-1 minute) in the control system. If pressure remains below the safety threshold or air flow is not detected for the selected time range, the well pump shall be shut down and locked out, and an alarm pilot light shall illuminate for the condition (low air flow pilot light, low pressure pilot lights). A reset pushbutton shall be furnished to reset this condition.
 - e. There is a single air flow transmitter for the blower. The output for the air flow transmitter shall be 4-20mA. Logic shall be provided for two separate programmable air flow levels to define that the blower is operating properly. One programmable level will be if a single well is called to operate with the blower operating at a lower flow and the other programmable level will be if two wells are called to operate with the blower operating at a higher flow.
 - f. In automatic mode, the blower shall shut down after an adjustable time period of 0-15 minutes after the well pump stops.
 - g. After the well pump is called to shut down, it shall continue pumping to clearwell 1 until clearwell 1 is full.
 - h. Normally open dry contacts shall be provided to call for blower operation for connection to the blower motor starters in the motor control center.
2. Blower 2, Transfer Pump Operation and Clearwell 1 Controls:
- a. The blower 2 motor shall be controlled by a Hand-Off-Auto switch. In the "Off" position, the blower motor shall not operate. In the "Hand" position, the blower motor shall run. In the "Auto" position, the blower shall start upon the call for the transfer pump to operate.
 - b. Each transfer pump motor shall be controlled by a Hand-Off-Auto switch. In the "Off"

position, the transfer pump motor shall not operate. In the "Hand" position, the transfer pump motor shall operate until the low level in clearwell 1 is reached. Upon low level, the transfer pumps shall shut down. In the "Auto" position, the transfer pumps shall operate at variable speed based upon the clearwell level as follows:

High Level Alarm	El. 100.50'
Lag Transfer Pump On	El. 99.50'
Lead Transfer Pump On	EL. 99.00'
Lag Transfer Pump Off	El. 95.50'
(minimum speed)	
Lead Transfer Pump Off	EL. 95.00'
Low Level Alarm	El. 94.00'

* Elevations shall be adjusted in the field during start-up.

- c. The transfer pumps in clearwell 1 shall not be associated with a particular well. One pump will be the lead pump, the other will be the lag pump, and a selector switch shall be provided to select which pump is lead.
- d. High and low level signals will be provided as dry contact closures from float switches in clearwell 1. As a redundancy, the control system shall also incorporate a pressure transducer to detect setpoints for the transfer pump controls. A selector switch shall be provided to select the control mode.
- e. If only one transfer pump is operational, only one well will be operating, and if a high level is reached in the clearwell, the well pump shall be shut down. When both transfer pumps and wells are operating (and water from both wells is being treated by the air stripper), and if a high level is reached, the most recently started well pump shall shut down.
- f. The well pump shall be shut down upon high level in clearwell 1. This shall be via the high level float switch.
- g. The transfer pumps shall be shut down upon low level in clearwell 1 (in Hand operation,

also backup safety shutdown in Auto operation). This shall be via the low level float switch. Manual reset will be required before returning to normal operation.

The transfer pumps shall be shut down upon high level in clearwell 2 (in Hand operation, also backup safety shut down in Auto operation). This shall be via the high level float switch. Manual reset will be required before returning to normal operation.

- h. Normally open dry contacts and a 4-20mA speed reference signal shall be provided to call for transfer pump operation for connection to the transfer pump VFDs in the motor control center.
- i. If after a well or transfer pump has shut down due to high level, it shall be capable of restarting upon the respective clearwell reaching low level. If the blower has stopped, it must start first and the preset time delay must elapse before the pump restarts.
- j. In automatic mode, once the blower starts, the blower has its own set of five safeties (suction air flow switch, discharge air flow switch, pressure switch, blower motor starter auxiliary contact and blower "motor running loaded" contact [from blower motor starter compartment]), which must be satisfied before the transfer pump shall be permitted to pump to the packed tower.
- k. The air flow switches, air flow transmitter and pressure switch safeties shall initiate timers (adjustable 0-1 minute) in the control system. If pressure remains below the safety threshold or air flow is not detected for the selected time range, the transfer pump shall be shut down and locked out, and an alarm pilot light shall illuminate for the condition (low air flow pilot light, low pressure pilot lights). A reset pushbutton shall be furnished to reset this condition.
- l. There is a single air flow transmitter for blower 2. The output from each air flow

transmitter shall be 4-20mA. Logic shall be provided for two separate programmable air flow levels to defines that the blower is operating properly. One programmable level will be if a single transfer pump is called to operate with the blower operating at a lower flow and the other programmable level will be if two transfer pumps are called to operate with the blower operating at a higher flow.

- m. In automatic mode, the blower shall shut down after an adjustable time period of 0-15 minutes after the well pump stops.
- n. After the transfer pump is called to shut down, it shall continue pumping to clearwell 2 until clearwell 2 is full.
- o. Normally open dry contacts shall be provided to call for blower operation for connection to the blower motor starters in the motor control center.

3. Booster Pump Operation and Clearwell Controls

- a. Each booster pump motor shall be controlled by a Hand-Off-Auto switch. In the "Off" position, the booster pump motor shall not operate. In the "Hand" position, the booster pump motor shall operate until the low level in clearwell 2 is reached. Upon low level, the booster pump shall shut down. In the "Auto" position, the booster pumps shall operate at variable speed based upon the clearwell 2 level as follows:

High Level Alarm	El. 100.50'
Lag Booster Pump On	El. 99.50'
Lead Booster Pump On	EL. 99.00'
Lag Booster Pump Off	EL. 95.50'
(minimum speed)	
Lead Booster Pump Off	EL. 95.00'
Low Level Alarm	El. 94.00'

* Elevations shall be adjusted in the field during start-up.

- b. The booster pumps in clearwell 2 shall not be associated with a particular well. One pump

will be the lead pump, the other will be the lag pump, and a selector switch shall be provided to select which pump is lead.

- c. High and low level signals will be provided as dry contact closures from float switches in clearwell 2. As a redundancy, the control system shall also incorporate a pressure transducer to detect setpoints for the booster pump controls. A selector switch shall be provided to select the control mode.
 - d. If only one booster pump is operational, only one transfer pump will be operating, and if a high level is reached in clearwell 2, the transfer pump shall be shut down. When both booster pumps and transfer pumps are operating (and water from both transfer pumps is being treated by the air stripper), and if a high level is reached, the most recently started transfer pump shall shut down.
 - e. The transfer pump shall be shut down upon high level in clearwell 2. This shall be via the high level float switch.
 - f. The booster pumps shall be shut down upon low level in clearwell 2 (in Hand operation, also backup safety shutdown in Auto operation). This shall be via the low level float switch. Manual reset will be required before returning to normal operation.
 - g. Normally open dry contacts and a 4-20mA speed reference signal shall be provided to call for booster pump operation for connection to the booster pump VFDs in the motor control center.
 - h. If after a transfer pump has shut down due to high level, it shall be capable of restarting upon clearwell 2 reaching low level. If the blower has stopped, it must start first and the preset time delay must elapse before the transfer pump restarts.
- C. Redundant control logic shall be provided for each level sensing system, float switches and pressure transducer. Either PLC logic or relay logic is permissible. Each level sensing system shall be

controlled by independent logic, in order that failure of a control component shall permit the other level sensing system to take over control of the booster pumps and/or transfer pumps.

D. Operator Interface Terminal (OIT)

1. An OIT shall be provided for setpoint of local booster pump control via system pressure.

E. Power supplies as required for air flow switches and air flow transmitters. Individual fused power supplies shall be provided.

F. Provide time delay in order that the well pump, transfer pump and booster pump do not start simultaneously.

I. Interface with SCADA System - RTU in the Well Building

1. The existing SCADA system shall be modified in accordance with Specification Section 18420.
2. I/O and control shall also be in accordance with the requirements of Specification Section 18420.

2.2 FABRICATION AND MANUFACTURE

A. Enclosure Construction and Materials:

1. Enclosure: The pump controls shall be housed in a NEMA 12 gasketed galvanized steel enclosure. The material used shall be 16-gauge steel. The enclosure shall be floor mount type sized to house all the required components and allow adequate space for testing and maintenance as necessary. The enclosure shall have backplate mounting studs and continuous hinge all of stainless steel. The door gasket shall be continuous rubber composition with a molded in spring steel retainer for attachment to the enclosure without the use of adhesives and provide a positive weatherproof door seal. Maximum enclosure dimensions shall be 90 inches high by 40 inches wide by 20 inches deep.
2. All control switches, indicator pilot lights and other pilot devices shall be mounted on the enclosure door.

B. Power Distribution:

1. The panel power distribution shall include all components as indicated below and be completely wired with stranded conductors having a minimum of 90 degree insulation rating and an amperage rating in accordance with NEC requirements. All power wiring shall be neatly routed and totally accessible. All conductor terminations shall be as recommended by the device manufacturer and be secure to provide adequate electrical conductivity.
2. Main Disconnect: The panel shall have a power source unfused disconnect for the 120-volt power feed. The continuous current rating shall be per NEC. The disconnect handle shall be totally accessible from the panel exterior.
3. The panel shall be provided with control power transformers and power supplies as required for a fully operational system. Control power transformers shall be provided with a suitable fusible switch on the primary and secondary sides of the transformers. Control power transformers shall be sized as required to power equipment as shown on the Contract Drawings.

C. Power Circuit Accessories:

1. The panel power accessories shall include all components as indicated below and be completely wired with stranded conductors. All wiring shall be neatly routed and sized as required with a minimum of number 12 AWG for power circuits and number 14 AWG for control circuits.
2. Control Circuit Breaker: The 120-volt common control circuit shall be protected by an auxiliary one-pole circuit breaker. The breaker handle shall project through the enclosure door.
3. Lightning Arrester: The control panel shall have lightning arrester protection included within the panel to protect the control equipment from lightning induced line surges. It shall be 600 volt rated and be a single phase unit with connection to ground. The arrester shall be mounted near the incoming power source and be properly wired.

The lightning arrester shall be a General Electric 9L15ECA001 or an approved equal.

4. Surge Capacitor: The control panel shall have surge capacitor protection included within the panel to protect the unit from damaging transient voltage surges. The surge arrester shall be mounted near the incoming power source and be properly wired.

The surge arrester shall be a General Electric 9L18BBB301 or an approved equal. (The specified capacitor is a three-pole device that can be applied with the single pole arrester by connecting the corresponding black leads and tying off the unused leads.)

5. The panel shall contain two (2) 4-20MA two channel signal splitters. Units shall provide two identical outputs from one input signal with LEDs to provide visual indication of operational process loops. Furnish and install power supply as required. Signal splitters shall be Alromay 653T or approved equal.

D. Control Components:

1. Terminal blocks shall be provided for all remote connections.
2. Control Relays: All control relays shall be miniature plug-in type with sealed clear plastic cases and internal indicating pilot light for coil energized. Provide surge suppressers across all relay coils.
3. Pilot Lights: Push-to-Test, 120 volt, heavy duty oiltight.
4. Selector switches and pushbuttons: Industrial, heavy duty, oiltight construction with clearly marked legend plates.

2.3 CLEARWELL LEVEL PRESSURE TRANSDUCERS

- A. The clearwell level pressure transducer system shall be a microprocessor based pressure measuring type device capable of providing an electronic output signal proportional to the level of liquid in the clearwell structure. The transducer shall be capable of

detecting the liquid level of water over a range of 2 to 12 feet with accuracy of 0.25% of full scale range.

- B. The transducer element shall be housed in a stainless steel casing with a vented gage and provided with a shielded, polyurethane 4 conductor, 22 AWG cable with integral vent tube. Nosecap fitting shall be open-faced. Wetted materials shall be 316 stainless steel. Output signal shall be 4-20 MA. The level transducer shall be mounted to the concrete clearwell wall in accordance with the manufacturer's recommendations with a 316 stainless steel bracket and stainless steel expansion anchors. Wiring between the transducer and the packed tower aeration system control panel shall be routed through grounded metal conduit.
- C. Model and Manufacturer: The level pressure transducer shall be model KPSI 720 as manufactured by Measurement Specialists, Hampton, VA, or approved equivalent.

2.4 OPERATOR INTERFACE TERMINAL

- A. The operator interface terminal shall be mounted to the face of the control panel and shall interface with the control panel PLC and I/O modules to provide pressure transducer clearwell level indication and level setpoint adjustment, and shall provide tower airflow rate indication and low air flow setpoint for panel control functions.
- B. The operator interface terminal shall be a monochrome transreflective LCD with integral LED backlight, 2.87-inch width by 1.67-inch height display with 128 by 64 pixel resolution.
- C. The operator interface terminal shall be provided with 8 function keys and a 10 digit stainless steel domed numeric keypad.
- D. The operator interface shall communicate with its respective PLC by DH-485 communication protocol.
- E. Electrical input voltage shall be 18-30 VDC. Power consumption shall be IDW max.
- F. Adjustment range for low airflow setpoint shall be 5,000-12,000 cfm, fixed. Adjustment range for clearwell level setpoints shall be fixed within the level range of high-high and low-low float switch

setpoints. High level shall be greater than low level setpoint.

- G. PLC addressing and logic shall be in accordance with control panel operation functions.
- H. Operator interface terminal shall be Allen-Bradley Panelview 300 Terminal with NEMA 4X rating, or approved equivalent.

2.5 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- A. The PLC shall be compatible with operator interface terminal and shall support logical functions as required to achieve specified control and monitoring functions.
- B. PLC requirements:
 - 1. Control of up to 4,096 discrete inputs and 4,096 discrete outputs, expandable. Minimum 20% spare input capacity and 20% spare output capacity.
 - 2. Program memory size as required, with 50% spare capacity.
 - 3. High speed performance - 0.90 ms/k typical.
 - 4. On-line programming.
 - 5. Ethernet, Data Highway Plus, DH-485, or RS-230.
 - 6. Remote I/O Passthrough.
 - 7. Built-in real-time clock/calendar.
 - 8. Advanced math features - trigonometric, PID, exponential, floating point and the compute instruction.
 - 9. Indirect addressing.
 - 10. Operating temperature: 0° to 60°C.
 - 11. Humidity: 5 to 95% (without condensation).
 - 12. Memory Type: Flash PROM.
 - 13. Card Wiring Density: No more than 16 for discrete I/O and 8 analog I/O per card.

14. Failsafe Design: All field I/O shall be failsafe design (normally closed when energized, opens on alarm).
15. Watchdog timer to external alarm to indicate Processor failure (failsafe). Process failure shall be indicated on touch screen operator interface.
16. Address Tags: In addition to standard addressing, Mnemonic address tags shall be used. The tag format shall match equipment identification with additional suffix added for use of instruction. The tags will be used in the SCADA system in the tag database.
17. Modular PLC system with spare slots in the chassis for expansion.
18. Shop drawings submittal shall include PLC logic (submit 30 days prior to panel testing).
19. In addition to each instruction, each rung shall be complete annotated to describe the functionality of the rung. In addition, both internal and real I/O shall be annotated with description.
20. Interposing relays shall be used on all PLC discrete outputs.
21. Provide surge suppression on the coil side of PLC controlled relays.
22. Inputs and outputs shall be fused in order that if one field device short circuits or fails, the rest of the I/O shall be unaffected and operable. Fuse condition shall be capable of being seen and fuses shall be capable of being changed without removing the board.
23. Software logic shall be provided to the Owner on CD media.
24. I/O Cards:
 - a. Digital I/O Modules
 - 1) Maximum 16 I/O per module

- 2) Interface as required to on-off sensors, devices, etc.
 - 3) Ladder logic shall have direct access to I/O values
 - 4) Outputs shall be relay contacts. Triac outputs are not acceptable
 - 5) Maximum 8 outputs per common
- b. Analog I/O Modules
- 1) Maximum 8 I/O per module
 - 2) D/A and A/D conversions to interface analog signals to data table values
 - 3) Ladder logic shall have direct access to I/O values
 - 4) High level resolution
- c. LED indicators to show input/output status
- d. Optical coupling and filter circuitry for signal noise reduction
- e. Environmental Conditions
- 1) Operational Temperature: 0 to 60°C
 - 2) Relative Humidity: 5 - 95% (without condensation)
- f. All I/O, including spares, shall be wired to terminal strip
- g. I/O boards shall not contain any pots to be adjusted
25. Scanner module when required for multiple remote I/O

C. Product and Manufacturer:

1. Allen-Bradley SLC 5/05 PLCs, Allen-Bradley 1746 series I/O modules and Allen-Bradley 1747 series scanner modules
2. Or approved equal.

D. Uninterruptible Power Supplies (UPSs):

1. The control panel PLC shall be supplied with an uninterruptible power supply (UPS) with sufficient capacity to supply the PLC with power for one hour in the event the primary power supply is unavailable. The UPS shall provide high-quality AC power for sensitive electronic equipment loads.
2. Standards:
 - a. UL Standard 1778 (suitable for computer room applications)
 - b. FCC Part 15, Subpart B, Class A
 - c. IEEE 587, Category A and B
 - d. ISTA Procedure 1A
3. System Description:
 - a. Modes of Operation: The UPS shall be designed to operate as a true on-line double conversion system in the following modes:
 - 1) Normal - In normal operation, incoming AC power is fed to the input power factor corrected (PFC) rectifier that converts the AC power to DC power for the inverter. In this mode, power is also derived from utility power for the battery charger. The inverter derives DC power from either the PFC rectifier or the battery and regenerated filtered and regulated AC sine wave power for the connected load. The battery shall be charged once the unit is connected to utility power, regardless of whether the UPS is ON or OFF. In the event of a utility outage or severe abnormality (sag or swell), the inverter shall support the connected load from battery power, until the battery is discharged or the utility returns, whichever occurs first.
 - 2) Battery - Upon failure of utility/mains AC power, the critical AC load shall be

supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility/mains AC source.

- 3) Recharge - Upon restoration of utility/mains AC power, after a utility/mains AC power outage, the input converter shall automatically restart and assume supplying power to the inverter and the battery charger to recharge the battery.
- 4) Automatic Restart - Upon restoration of utility/mains AC power, after a utility mains AC power outage and complete battery discharge, the UPS shall automatically restart and assume supplying power to the critical load and the battery charger shall automatically recharge the battery. This feature shall be capable of being disabled by the user.
- 5) External Maintenance Bypass Switch - The integral bypass shall perform an automatic transfer of the critical AC load from the inverter to the bypass source, in the event of an overload, PFC failure, over temperature, DC Bus over voltage, or inverter failure conditions.

4. Design Requirements:

- a. Voltage - Input/output voltage specifications of the UPS shall be:

Input: 0-140 VAC, 60/50 Hz, single-phase, 2-wire-plus-ground.

Output: 120 VAC (user configurable): 100V, 110V, 115V, 120V, 127V) $\pm 3\%$, 60/50, single-phase, 2-wire-plus-ground.

- b. Output Load Capacity: Specified output load capacity of the UPS shall be:

700 VA/490 watts at 0.7 lagging power factor.

1,000 VA/700 watts at 0.7 lagging power factor.
1,500 VA/1,050 watts at 0.7 lagging power factor.
2,000 VA/1,400 watts at 0.7 lagging power factor.
2,700 VA/1,890 watts at 0.7 lagging power factor.
3,000 VA/2,100 watts at 0.7 lagging power factor.

- c. Internal Battery: Valve regulated nonspillable, flame retardant, lead acid cells.
- d. Reserve Time: 700 VA minimum 17 minutes, 1,000 VA minimum 11 minutes, 1,500 VA minimum 7 minutes, 2,000 VA minimum 6 minutes, 2,700 VA minimum 5 minutes, 3,000 VA minimum 5 minutes, these times are at full load with ambient temperature of 25°C (77°F).
- e. Battery Recharge: The UPS shall contain a battery recharge rate designed to prolong battery life. Recharge time for UPS internal batteries shall be 5 hours maximum to 90% capacity after a complete discharge into full load.

5. AC Input Performance Requirements:

- a. Frequency: UPS shall auto sense input frequency when first powered up and shall operate within the frequency specifications stated herein. UPS shall be capable of cold start with default frequency of 60 Hz. Once started, frequency operating window shall be 40 to 70 Hz.
- b. Input Power Factor: >0.97 lagging at rated load.
- c. Input Current Reflected Distortion: 25% THD maximum.
- d. Inrush Current (initial start up, no load): The UPS shall have a maximum inrush current of 6 times the full load peak input current.

- e. Input line Transient Immunity: UPS shall conform to an input line transient conforming to IEEE 587, Category A and B tests.
- f. Surge Protection: MOV ratings shall be 175 volt, 90 Joules minimum connected L-N. The MOVs shall be rated 300 volt, 150 Joules minimum connected L-G and N-G. The L-G and N-G connected MOVs shall have the capability of being disconnected and reconnected easily.

6. AC Output Performance Requirements:

- a. Voltage Regulation: $\pm 3\%$ steady state.
- b. Frequency Regulation: $\pm 5\%$ synchronized to utility/mains. ± 0.1 Hz free running or on battery operation.
- c. Frequency Slew Rate: 1.0 Hz per second maximum.
- d. Voltage Distortion: $\leq 3\%$ total harmonic distortion (THD) typical into a 100% linear load, $\leq 5\%$ THD typical into a 100% nonlinear load with crest factor ratio of 3:1.
- e. Load Power Factor Range: 0.65 lagging to 1.0 (unity).
- f. Output Power Rating: 700 VA/490 watts, 1,000 VA/700 watts, 1,500 VA/1,050 watts, 2,000 VA/1,400 watts, 2,700 VA/1,890 watts, 3,000 VA/2,100 watts at 0.7 lagging power factor.
- g. Inverter Overload Capability: 112-103%, $\pm 10\%$ for 10 seconds then transfer to bypass, 131-200%, $\pm 10\%$ for 2 seconds then transfer to bypass, $> 201\%$, $\pm 10\%$ for 96 milliseconds then transfer to bypass.
- h. Voltage Transient Response: $\pm 7\%$ in line mode 0-100-0% loading of the UPS, $\pm 7\%$ in battery mode for 0-100-0% loading of the UPS rating.
- i. Transient Recovery Time: To nominal voltage within 90 milliseconds.
- j. Efficiency: $\geq 88\%$ AC-AC, minimum.

7. Environmental Conditions:

a. Ambient Temperature:

- 1) Operating: 0°C to +40°C (+32°F to +104°F).
- 2) Storage: -15°C to +50°C (+5°F to +122°F) with batteries removed.

8. Relative Humidity:

- a. Operating: 0 to 95% noncondensing.
- b. Storage: 0 to 95% noncondensing.
- c. Audible Noise: Noise generated by the UPS under normal operation shall not exceed 50 dBA when measured at 1 meter from the surface of the UPS.
- d. Electrostatic Discharge: The UPS shall be able to withstand an electrostatic discharge compliant to ENC61000-4-2, level 4 (15 kV through air, 8 kV contact) without damage and will not affect the connected load.

9. Quality Assurance:

- a. Manufacturer Qualifications: A minimum of 10-year's experience in the design, manufacture and testing of solid-state UPS systems is required. The manufacturer is certified to ISO 9001.
- b. Factory Testing: Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification. These tests include operational discharge and recharge tests on the internal battery to assure performance.

10. Components:

- a. Cabinet: The UPS unit shall be comprised of input converter, battery charger, inverter and battery consisting of the appropriate number of sealed battery cells, and shall be housed in a rack-tower NEMA type 1 enclosure and meet the requirements of IP20. The UPS

cabinet shall be cleaned, primed and painted IBM black.

b. Cooling: The UPS shall be forced air cooled by an internally-mounted continuous fan. Fan power shall be provided from the internal DC supply. Air intake is through the front of the unit and exhausted out the rear of the unit.

c. Input Converter:

- 1) General: Incoming AC power shall be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor correction and input current distortion reduction.
- 2) AC Input Current Limit: The input converter shall be provided with AC input current limiting whereby the maximum input current is limited to 125% of the full load input current rating.
- 3) Input Protection: The UPS shall have built-in protection against under voltage, over current and over voltage conditions including low-energy lighting surges, introduced on the primary AC source. The 120 VAC models shall be capable of sustaining input surges without damage per criteria listed in IEEE 587 CAT. A and B. UPS shall have input fuses.
- 4) Battery Recharge: The UPS shall contain a battery recharge rate designed to prolong battery life. The battery shall be constant current charged to restore capacity, then shall be constant voltage charged to maintain the battery in a fully charged state. Recharge time for the internal UPS batteries shall be 5 hours maximum to 95% capacity (full load discharge rate). There shall be DC over voltage protection so that if the DC voltage exceeds the pre-set limit, the UPS shall shut down automatically

and the critical load shall be transferred to bypass.

d. Inverter:

- 1) General: The UPS inverter shall be a pulse-width-modulated (PWM) design capable of providing the specified AC output. The inverter shall convert DC power from the input converter output or the battery, into precise sine wave AC power for supporting the critical AC load.
- 2) Overload: The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective devices.
- 3) Inverter DC Protection: The inverter shall be protected by the following DC shut down levels:

DC Over Voltage Shutdown

DC Under Voltage Shutdown (end of discharge)

DC Under Voltage Warning (low battery reserve); factory default set at 2 minutes (user configurable 2 to 30 minutes)
- 4) Output Frequency: The inverter shall hold the output frequency to ± 0.1 Hz of nominal when not synchronized to the utility/mains source.

- 5) Output Protection: The UPS inverter shall employ electronic current limiting circuitry.
- 6) Battery Over Discharge Protection: To prevent battery damage from over discharging, the UPS control logic shall automatically raise the shutdown voltage set point; dependent upon output load at the onset of battery operation.

e. Display and Controls

- 1) General: The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. The monitoring functions such as status and alarm indicators shall be displayed on an LED display.

- 2) System Indicators: The UPS shall contain a row of LEDs to indicate UPS load and battery capacity and five single LEDs to indicate UPS status as described below:

The "Fault" LED indicator illuminates red to indicate a UPS fault condition.

The "Battery" LED indicator illuminates amber to indicate the UPS is operating from battery power.

The "Bypass" LED indicator illuminates amber to indicate the UPS is operating on Bypass power.

An audible alarm is provided and activated by any of the above alarm conditions.

The "UPS ON" LED indicator illuminates green to indicate the UPS inverter is operating and supplying power.

The "AC Input" LED indicator illuminates green to indicate the UPS is operating from utility/mains power.

- 3) Controls: UPS start up and shut down operations shall be accomplished by the

"ON" and "OFF" pushbuttons located on the front panel of the UPS. The "ON" pushbutton is a means to turn the UPS on and also serve as a means to manually test the battery and to reset active visual and audible alarms. The "OFF" pushbutton allows manual transfers of the load from the inverter to bypass power. Pressing the "OFF" pushbutton twice within a 4-second time period will completely shut down the UPS and its connected load in normal and battery mode.

f. On-line Battery Test:

- 1) The UPS shall be provided with an automatic biweekly battery test feature (factory default). Via the set-up configuration program on a Windows based PC, the automatic battery test can be disabled or configured to operate every 7, 14, 21 or 28 days.
- 2) The battery test shall ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS shall display a warning message to indicate the internal batteries need to be replaced. The battery test feature shall be user accessible by the pushbutton located on the front of the unit and with Communications Software. The Automatic Battery test feature shall be capable of being disabled through the User Configuration Program shipped with the UPS.

g. External Maintenance Bypass Switch:

- 1) General: An external maintenance bypass switch bypass shall be provided remote to the UPS on the exterior of the panel enclosure. The switch shall be made before break type, which shall allow switching while on line and periodic testing of the UPS without system shut down. The bypass control logic shall contain an automatic transfer control

circuit that senses the status of the inverter logic signals, and operating alarms conditions. This control circuit provides a transfer of the load to the bypass source if available, and if the inverter is capable of powering the load (i.e., overload condition, if your unit is in Manual Bypass Mode, or if the voltage and/or frequency is out of tolerance).

- 2) Automatic Transfers: The transfer control logic shall automatically activate the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

- UPS overload
- UPS over temperature
- PFC failure
- Inverter failure
- DC Bus over voltage

Once overload condition is reduced, the load shall be automatically transferred back to inverter power.

- h. Internal Battery: Valve regulated, nonspillable, flame-retardant lead acid cells shall be used as a stored-energy source for the specified UPS system. The battery shall be housed internal to the UPS cabinet, and sized to support the inverter at rated load and power factor, with ambient temperature of 25°C (77°F) for a minimum of 7 minutes reserve time. The expected life of the battery shall be 3 to 5 years or a minimum 250 complete discharge cycles. The UPS units shall have the capability to allow the operator to replace the internal battery.

- i. Communications:

- 1) The UPS shall contain a DB9F (9-pin female) connector on the rear panel to allow UPS status communications to a computer system. The DB9F contains photo couplers to signal on battery and low battery operational status.

- 2) The UPS shall contain one Intellislot communication port to allow the operator to field install optional communication cards. These optional cards shall allow the UPS to communicate via Ethernet SNMP, connected directly to the LAN. Once the SNMP card is installed, the serial communications is disabled in the DB9F connector; however, the photo-coupler signals (on battery, and low battery) shall remain active.
- 3) UPS alarm status shall be wired to the PLC system using fail safe design.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall survey the site to determine the existing well control system for integration of the new control modifications required by this work.
- B. Electrical Connections:
 1. Electrical connections from the control panel to the main power source and other appurtenant equipment such as alarms, etc., shall be performed under the Electrical Construction Contract, under Division 16.
- C. Protection During Construction:
 1. The control panel shall be protected from moisture, dust and dirt both during storage and after installation for the entire construction period.
 2. The space heater in the panel shall be energized while the panel is in storage and after installation prior to start-up of the station.

3.2 SPARE PARTS

- A. The following spare parts and devices shall be furnished with the control panel:
 1. Two pilot light assemblies and switches of each type used.

2. Two relays of each type used.
3. Two boxes (minimum of 24) of spare lamps for each type used.
4. Two fuses of each type used.
5. Two circuit breakers of each type used.

3.3 DRAWINGS AND MARKINGS

- A. Panel Marking: All component parts in the control panel shall be permanently marked and identified as they are indicated on the control drawings. Marking shall be on the backplate adjacent to the component.

All control panel conductors shall be permanently number marked with wire markers at each end as close as practical to the termination of the conductor.

- B. Nameplates: The panel shall include engraved nameplates for all components to indicate the device function. The nameplates shall be permanently affixed with plated machine screws or a bonding adhesive suitable for the application. The material shall be white with a black core and have a minimum of 3/16-inch letters. All screws on the panel exterior shall be stainless steel.

- C. Submittal Drawings: The Contractor shall provide a complete set of shop drawings as outlined in these specifications prepared by the manufacturer and submitted to the Engineer for review prior to the fabrication of the equipment. The shop drawings shall include control schematics, a terminal connection diagram and a panel layout with dimensions. A component Bill of Materials shall be submitted and include each component reference, quantity, description, manufacturer and part number. The layout drawing must show the general arrangement and location of each component. The control schematic must show all component markings and wire numbers. The schematics shall be specific for the control panel being considered and not general in nature. The terminal connection diagram must show all field connections and the devices to which they are connected. Line numbers and relay cross references shall be included on the schematic drawings.

Shop Drawings shall also contain a detailed description of operation and a description of the control logic

referencing the schematic drawings. Shop drawings will not be reviewed without this detailed description and will be returned marked "Not Reviewed."

3.4 FINAL INSTALLATION AND START-UP

- A. Manufacturer's Representative: The services of a factory trained, qualified representative of the manufacturer shall be provided to inspect the completed installation and make all adjustments necessary to place the system in trouble-free operation. The representative shall furnish written certification that the panel is operating properly and meets Contract Documents. The representative shall instruct the operating personnel in the proper care and operation of the equipment, prior to the final acceptance of the work. Contractor shall allow for two full days for start-up services.
- B. Electrical and Controls Testing: All control operations for manual and automatic operation shall be tested and evaluated. The satisfactory operation of all system alarms shall be tested.

3.5 MANUFACTURER

- A. The manufacturer shall provide data, upon request, that it has a minimum of 10 years experience in the production of this specific type of control panel. The manufacturer shall have a test facility to allow testing of the completed panel. The control panel shall be manufactured by Eagle Control Corp., Yaphank, Long Island (631) 924-1315, or approved equal.

3.6 GUARANTEE

- A. All equipment shall be guaranteed against defects in material and workmanship for a minimum period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

+ + END OF SECTION + +

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SECTION 18400

WATER TREATMENT CHEMICAL SAFETY CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals to furnish and install a Water Treatment Chemical Safety Control Panel for the Booster Pumps as shown on the Drawings and specified herein. Treatment consists of a lime slurry metering pump for each Booster Pump.
2. The Contractor shall perform modifications to the existing Chemical Safety Controls for Wells 7A and 8A as shown on the Drawings and described herein. This shall include adding relays as required for the SCADA I/O.
3. Status and alarm outputs shall be provided from the existing Water Treatment Chemical Safety Control Panel (well pumps) and the new Chemical Safety Panel (booster pumps) to the SCADA panel.
4. A new phosphate metering pump will be added for treatment to Well 7A.

B. Coordination:

Coordinate the Water Treatment Safety Control System with the existing metering pumps, flow switches, pressure switches, chlorine analyzer, pH analyzer, etc.

C. Related Work Specified Elsewhere:

1. Section 18099, Large Diameter Valves, Specials and Appurtenances for Discharge Valve Limit Switches.
2. Section 18180, Miscellaneous Appurtenances
3. Section 18420, SCADA System Work.
4. Division 16, Electrical.

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
 - 1. NFPA 70, National Electrical Code.
 - 2. Nassau County Department of Health.
- B. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified.
 - 1. UL #508A, Standard for Industrial Control Panels.
 - 2. NEMA Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Shop drawings shall be submitted for approval prior to fabrication in accordance with the requirements of the Special Conditions of these specifications.
 - 2. Shop drawings shall include physical arrangement of the control panels, internal details, wiring diagrams, control schematics, description of components and nameplate schedule.
 - 3. Complete point-to-point wiring diagrams shall be provided.
 - 4. Control schematics shall be referenced to a detailed written description of the functions of all switches, relays and time delays. Wiring diagrams will not be reviewed without this detailed functional description. Descriptions shall include, as applicable, but shall not be limited to the following:
 - a. Operation of the panel including the interfacing with auxiliary equipment.
 - b. Descriptions shall be complete and shall be the basis of instruction for operation and maintenance personnel.

B. Test Procedures:

The control panels shall be electrically and operationally tested at the factory in accordance with an approved test procedure. Certified test reports shall be submitted to the engineer prior to shipment to the job site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. The Control panel enclosure shall be NEMA 12, gasketed. Enclosure dimensions shall be 20-inch wide by 48-inch high by 20-inch deep.
2. All lights, switches, indicators and other operable or visual components shall be mounted on the door and shall be grouped together in a logical fashion and shall be permanently labeled.
3. All points of connection to external wiring shall be wired by the vendor to a master terminal board with all wires and terminals being properly identified. Wiring diagrams shall be equivalent to NEMA Class II, Type C.
4. All indicating lights shall be heavy duty, oiltight, push-to-test. Lens color will be determined during shop drawing review.
5. All switches shall be heavy duty, oiltight. Contacts shall have NEMA A600 rating.
6. Control logic shall be relay-based. All relays shall be of the plug-in industrial control type. Contacts shall have NEMA A600 rating. Relays shall be provided with transient suppressors and coil indicating lights. Timer attachments for industrial relays shall be of the solid-state type. Number of contacts shall be as required.
7. All contact outputs shall be Form C, single pole double throw.

2.2 WATER TREATMENT CHEMICAL SAFETY CONTROL PANEL - BOOSTER PUMPS

- A. The purpose of the Water Treatment Chemical Safety Control Panel is to control the operation of the lime chemical metering pumps and related chemical injection piping solenoid valves. The control panel shall accept connections from the remote safety interlocks as described herein.
- B. The control panel shall be suitable for service from a 30 amp, single phase (including ground and neutral), 120 volt power supply. The control panel shall power the pumps and related control circuitry to permit chemical pump operation.
- C. The following shall be furnished for each of the metering pumps:
 - 1. A NEMA size 0 single phase combination circuit breaker type starter with thermal overload protection. The breaker handle shall be internal to the panel. Auxiliary contacts shall be furnished as required, with 1 normally open and 1 normally closed spare.
 - 2. An "Off-Auto" selector switch.

In the "Auto" position, the feed pump shall operate if all related safety interlocks are satisfied.
 - 3. A "pump run" pilot light.
 - 4. A "pump off" pilot light.
 - 5. A "pump fault" pilot light (pump fault is defined as the pump not operating when called to operate).
- D. The following safety interlocks shall prevent operation of the metering pumps as indicated:
 - 1. Booster Pump Metering Pump (Lime Pump) Safeties (typical for each Booster Pump):
 - a. Dry contact from Booster Pump motor starter.
 - b. Dry contact from limit switch on Booster Pump discharge.

- c. Dry contact from flow switch on Booster Pump discharge (Packed Tower Building).
 - d. Dry contact from flow switch on Booster Pump discharge (Venturi in Well Building).
 - e. Dry contact from pH analyzer that opens on high pH condition.
- E. Lime Feed System: When the chemical safeties are satisfied, provide associated control logic and power to open the existing solenoid valve on the lime slurry feed piping. After the solenoid valve is called to open, there shall be an adjustable time delay (0 to 30 seconds) to start the lime slurry pump. Contractor shall confirm that the existing solenoid valves are energize to open, fail closed. When the lime slurry pump is called to shut down, the lime slurry pump shall shut down and then the solenoid valve shall close.
- F. The safety interlock contacts are normally open and close to permit chemical feed.
- G. Provide a 4-position selector switch "Norm-Off-Weld-Relay Test."
- H. "Device Test" switch position is intended to be used when all safety devices should be open by alarming and providing visual indication of which switch is closed, if any one or more switch is closed.
- I. The "Weld" position shall permit the operator to check relay and lamp operation.
- J. The control panel shall contain the following pilot lights and associated logic as required:
- 1. Booster Pump (type for each Booster Pump):
 - a. Limit switch made
 - b. Flow switch made (Packed Tower Building)
 - c. Flow switch made (Venturi in Well Building)
 - d. Booster pump running
 - e. Call for Lime Slurry Pump
 - f. Lime Slurry Pump running

- g. Lime Slurry Pump off
 - h. Lime Slurry Pump fault
 - i. pH normal
 - j. High pH level
- K. The contacts from the pH analyzer shall initiate a timer (adjustable 0-3 minutes) in the control panel upon a high level condition. If the condition remains high for the selected time range, the safety shall not be satisfied and the respective pumps shall be shut down if they are operating. When the condition returns to a normal level, there shall also be an adjustable time period (0-3 minute timer) that the chemical safety must be at the "normal" level in order for the safety to be satisfied.
- L. The control panel shall contain elapsed time meters for each of the lime slurry metering pumps (hours, nonresettable, 6 digit) that shall be triggered when the pump's safety interlocks are satisfied.
- M. The control panel shall have dry contact outputs for connection of status signals to the SCADA panel. Refer to Subsection 2.3 for the outputs required to the SCADA panel.
- N. The control panel shall contain a lightning arrestor and surge protection.
- O. The control panel shall be provided with a control power supply fuse, switch and pilot light.

2.3 OUTPUTS TO SCADA FROM WATER TREATMENT CHEMICAL SAFETY PANEL

- A. Provide one normally open and one normally closed dry contact for each of the status and alarm conditions in subsection 2.2.J, as well as "Well Pump Safeties Satisfied" and "Booster Pump Safeties Satisfied."

2.4 PRODUCT AND MANUFACTURER

- A. The control panels shall be manufactured by Eagle Control Corp., Yaphank, New York, telephone number (631) 924-1315, PCS Systems Integrators and Contractors, Fairfield, New Jersey, telephone number (973) 575-7464, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Electrical Connections:

1. All electrical connections from the control panels to the main power source and other appurtenant equipment shall be performed by the Electrical Contractor.

B. Protection During Construction:

1. The control panels shall be protected from moisture, dust and dirt both during storage and after installation for the entire construction period.

3.2 FIELD QUALITY CONTROL

A. Supervision:

1. The control panel manufacturer shall provide a service representative to insure that all external wiring connections made by others are correct and shall so certify in writing to the Engineer. He shall make all final adjustments to place the equipment in proper operating order. He shall be available during the control panel testing period and complete testing period of the pumping system. He shall provide separate instructional services as specified herein.

B. Service:

1. The vendor shall furnish the services of a qualified operating and maintenance technician for start-up at the site to check and certify proper installation, and to demonstrate proper operation.

3.3 SPARE PARTS

A. The following spare parts shall be furnished:

1. 4 pilot light lamp bulbs.
2. 4 sets of fuses of each size and type.
3. One control transformer for each size and type.

4. 2 relays for each size and type.

5. 2 timers/time delay relays for each size and type.

B. Parts Lists:

Complete parts lists for each item included in each control panel including a reference to a drawing number locating the specific part shall be provided.

If the part is not of the Vendor's manufacture, he shall completely identify the name of the distributor (must be the local distributor not the distributor in the vendor's geographic area) address and phone number of this source of the equipment.

C. A price list for all parts shall be supplied.

3.4 MANUFACTURER TRAINING

A. The Contractor shall furnish the services of qualified factory trained specialists from the manufacturer to instruct the operations and maintenance personnel in the recommended operation and maintenance of this equipment. A minimum of one (1) day of instruction of personnel shall be included.

3.5 GUARANTEE

A. All equipment shall be guaranteed against defects in material and workmanship for a minimum period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

+ + END OF SECTION + +

SECTION 18420

SCADA SYSTEM WORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope of Work: The Owner's SCADA system supplier shall provide modifications to the SCADA system as described herein (Bid Item 2 - SCADA System Allowance).
- B. The SCADA System Supplier shall be responsible for the following:
 - 1. Replacement of the existing RTU in the Well Building.
 - 2. Furnishing and installing an RTU in the Booster Building.
 - 3. Additions and modifications to the computer system screens at the East Meadow Main Office to incorporate the Well Building and Packed Tower Building.
 - 4. Communications from the Well Station to East Meadow Main Office.
 - 5. Programming.
 - 6. Startup and testing.
 - 7. Interfacing and communicating with the Packed Tower Aeration System Control Panel, which shall serve as an RTU in the Packed Tower Building.
- C. Related Work Specified Elsewhere:
 - 1. Section 16920, Motor Control Center and Variable Frequency Drives.
 - 2. Section 18380, Packed Tower Aeration System Control Panel.
 - 3. Section 18400, Water Treatment Chemical Safety Control System.

4. Section 18440, Well Blowoff Valve Control Panels.

1.2 QUALITY ASSURANCE

A. SCADA System Supplier:

1. The SCADA System Supplier, as directed by the Owner, shall be Eagle Control Corp., Yaphank, New York, telephone number (631) 924-1315.
2. A single SCADA System Supplier shall be retained to furnish start-up services required by this specification section.
3. Reference standards: The Contractor shall comply with applicable provisions and recommendations of the following:
 - a. National Electrical Code
 - b. Underwriters Laboratories, Incorporated
 - c. Factory Mutual
 - d. National Electrical Manufacturers Association
 - e. Occupational Safety and Health Act.

1.3 SUBMITTALS

- ### **A. Shop Drawings:** The Contractor shall submit for approval the following:
1. Manufacturer's literature, illustrations, specifications and engineering data including: general arrangement, outline drawings, dimensions, materials, size, weight, and performance data.
 2. Fabrication, assembly and installation drawings and details, including physical arrangement of the control panel, internal details, description of components, nameplate schedule and wiring diagrams.
 3. Complete point-to-point wiring diagrams.
 4. Description of system operation, including operation of the RTU; communication between the RTU

and computer stations; control and monitoring functions.

5. Operating screens for the computer stations.

6. Reports for the computer station.

1.4 GENERAL

- A. Material: All electrical components and materials supplied shall function as a complete unit to automatically control the packed tower aeration system. All devices and material shall be new and of standard product design.
- B. UL Label: The control panel enclosure shall be in accordance with Underwriters Laboratories and must bear the manufacturer's UL label for enclosures to indicate and qualify same.
- C. The control panel assembly and wiring shall be constructed in accordance with Underwriters Laboratories UL508. All components used in the panel shall be Underwriters Laboratories approved for the application. Electrical work shall be in accordance with the latest edition of the National Electrical Code and all local codes.
- D. Manufacturer Nameplate: There shall be permanently affixed to the inside of the exterior enclosure door a nameplate indicating the order reference number, date manufactured and the control panel manufacturer's name, address and telephone number.
- E. Wiring: All power wire shall be stranded and sized as required for load and application according to the NEC. All control and signal wire shall be a minimum of #14 AWG, 90 degree insulated and color coded. Colors shall be red for all AC control, yellow for external source control, white for AC neutral and green for equipment ground wiring. All wiring on the rear of the inner door shall be neatly bundled using tie wraps or other means. All internal wiring on the backplate shall be neatly routed in wire duct with removable covers. All wiring shall be continuous point to point (no splices) and be totally accessible with permanent number marking on each end to match the control schematic drawings.

- F. Quality Control and Testing: The panel shall be manufactured using quality workmanship and components. Upon completion of the panel it shall be completely factory tested. All control and alarm operations shall be performed with external signals simulated to ensure proper sequencing and operation. Submit certified test reports to the Engineer prior to shipment. The line voltage for which the panel is intended shall be used for testing.

PART 2 - PRODUCTS

2.1 SCADA SYSTEM ADDITIONS

- A. The SCADA System Supplier shall provide additions and modifications to the SCADA system (software, computer screens, etc.) at the Main Office to incorporate the following system modifications:

1. Incorporate new I/O for Well Station No. 7A/8A into the SCADA system. The functions, alarms and status indications shall be identical to those for the Owner's other wells, with the addition of the Packed Tower Aeration System.
2. Update the alarm screen for the new RTUs.

- B. Security System:

1. Incorporate security system at Well Station 13 (card readers, key switches, magnetic door switches) into the SCADA system.
2. When activated, the card reader disables the building access alarm for 45 minutes, at which time the alarm is automatically rearmed. The card reader logs the employee's name, RTU identification and timestamp on the database history.
3. A key switch is mounted on the interior of the building near the door equipped with the card reader. The key switch has two positions; one position enables the alarm, one position disables the alarm. The key switch should include a three minute time delay upon alarm activation to allow

the operator to exit the building and door to close before the alarm system is reactivated.

4. Door switches will be installed on all manddoors and the rollup door.
 5. The devices will be furnished, installed and wired by the Electrical Contractor.
- C. Furnish and install additional hardware, interconnections, etc. at the Main Office as required to accomplish the above.
- D. The existing SCADA screens at the Main Office depict a minimum level of effort required for the system additions.
- E. The RTU shall be provided with an OIT.
- F. Workshop meetings shall be held with the Town and Engineer to discuss, review and coordinate graphics of operating screens.

2.2 FABRICATION AND MANUFACTURE

A. Enclosure Construction and Materials:

1. Enclosure: The RTU shall be housed in a 30" wide x 30" high x 12" deep wall mount enclosures.

B. Power Distribution:

1. The panel power distribution shall include all components as indicated below and be completely wired with stranded conductors having a minimum of 90 degree insulation rating and an amperage rating in accordance with NEC requirements. All power wiring shall be neatly routed and totally accessible. All conductor terminations shall be as recommended by the device manufacturer and be secure to provide adequate electrical conductivity.
2. Main Disconnect: The panel shall have a power source unfused disconnect for the 120-volt power feed. The continuous current rating shall be per NEC. The disconnect handle shall be totally accessible from the panel exterior.

C. Power Circuit Accessories:

1. The panel power accessories shall include all components as indicated below and be completely wired with stranded conductors. All wiring shall be neatly routed and sized as required with a minimum of number 12 AWG for power circuits and number 14 AWG for control circuits.
2. Control Circuit Breaker: The 120-volt common control circuit shall be protected by an auxiliary one-pole circuit breaker. The breaker handle shall project through the enclosure door.
3. Lightning Arrester: The control panel shall have lightning arrester protection included within the panel to protect the control equipment from lightning induced line surges. It shall be 600 volt rated and be a single phase unit with connection to ground. The arrester shall be mounted near the incoming power source and be properly wired.

The lightning arrester shall be a General Electric 9L15ECA001 or an approved equal.

4. Surge Capacitor: The control panel shall have surge capacitor protection included within the panel to protect the unit from damaging transient voltage surges. The surge arrester shall be mounted near the incoming power source and be properly wired.

The surge arrester shall be a General Electric 9L18BBB301 or an approved equal. (The specified capacitor is a three-pole device that can be applied with the single pole arrester by connecting the corresponding black leads and tying off the unused leads.)

5. Receptacle for UPS.

D. Control Components:

1. Terminal blocks shall be provided for all remote connections.

2. Control Relays: All control relays shall be miniature plug-in type with sealed clear plastic cases and internal indicating pilot light for coil energized. Provide surge suppressers across all relay coils.
3. Pilot Lights: Push-to-Test, 120 volt, heavy duty oiltight.
4. Selector switches and pushbuttons: Industrial, heavy duty, oiltight construction with clearly marked legend plates.
5. Programmable Logic Controllers (PLCs)
 - a. Control of up to 4,096 discrete inputs and 4,096 discrete outputs, expandable. Minimum 20% spare input capacity and 20% spare output capacity.
 - b. High speed performance - 0.90 ms/k typical.
 - c. On-line programming.
 - d. Remote I/O Pass-through.
 - e. Built-in real-time clock/calendar.
 - f. Advanced math features - trigonometric, PID, exponential, floating point and the compute instruction.
 - g. Indirect addressing.
 - h. Operating temperature: 0° to 60°C.
 - i. Humidity: 5 to 95% (without condensation).
 - j. Memory Type: Flash PROM.
 - k. Card Wiring Density: No more than 16 for discrete I/O and 8 analog I/O per card.
 - l. Failsafe Design: All field I/O shall be failsafe design (normally closed when energized, opens on alarm).

- m. Watchdog timer to external alarm to indicate processor failure (failsafe). Processor failure shall be indicated on a pilot light.
- n. Modular PLC system with spare slots in the chassis for expansion.
- o. Interposing relays shall be used on all PLC discrete outputs.
- p. Provide surge suppression on the coil side of PLC controlled relays.
- q. Inputs and outputs shall be fused in order that if one field device short circuits or fails, the rest of the I/O shall be unaffected and operable. Fuse condition shall be capable of being seen and fuses shall be capable of being changed without removing the board.
- r. I/O Cards
 - 1) Digital I/O Modules
 - a) Maximum 16 I/O per module.
 - b) Interface as required to on-off sensors, devices, etc.
 - c) Ladder logic shall have direct access to I/O values.
 - d) Outputs shall be relay contacts. Triac outputs are not acceptable.
 - e) Maximum 8 outputs per common.
 - 2) Analog I/O Modules
 - a) Maximum 8 I/O per module.
 - b) D/A and A/D conversions to interface analog signals to data table values.
 - c) Ladder logic shall have direct access to I/O values.

- d) High level resolution.
- 3) LED indicators to show input/output status
- 4) Optical coupling and filter circuitry for signal noise reduction
- 5) Environmental Conditions
 - a) Operational Temperature: 0 to 60°C
 - b) Relative Humidity: 5 - 95%
(without condensation)
- 6) All I/O, including spares, shall be wired to terminal strip.
- 7) I/O boards shall not contain any pots to be adjusted.
- s. Product and Manufacturer:
 - 1) Allen-Bradley Compact Logix with hardware as required to interface Allen-Bradley PLCs with existing SCADA system hardware and software.

6. Operator Interface Terminals:

- a. Operator interface terminals (OITs) shall be 12-inch, Allen-Bradley Panelview Plus 6 touch screen workstation.
- b. Graphic terminal shall provide VGA/SVGA color graphics.
- c. The OITs shall communicate with their respective PLCs by Allen-Bradley DH+ or Ethernet.
- d. Screen configuration shall be performed using software. Configuration shall use preconfigured symbols and dynamic objects. Features shall include tag editor, cut/copy/paste, selection from toolbars and the ability to work with multiple screens.

- e. PLC addressing and logic required for control functions.
 - f. Electrical input voltage shall be 90-132 volts, AC. Maximum power consumption shall be 240 VA.
 - g. Operator interface colors shall be as follows:
 - 1) Equipment run shall be green.
 - 2) Equipment stopped or off shall be white.
 - 3) Equipment alarm, malfunction or overload shall be red.
 - 4) Valve closed status shall be amber.
 - 5) Valve open status shall be blue.
 - h. Software shall be provided to the Owner on CD media.
7. Uninterruptible Power Supply (UPS)
- a. The control panel shall be supplied with a UPS with sufficient capacity to supply the control panel with power for one-half hour in the event the primary power supply is unavailable.
 - b. Dedicated UPS receptacle in the control panel.
 - c. UPS shall be manufactured by APC or approved equal.
8. 24V DC Power Supply.
9. Ethernet switch.

2.3 INPUTS/OUTPUTS TO SCADA SYSTEM**A. New SCADA RTU - Well Building**

Device/Equipment	Description	Type	Remarks
Phase Failure Relay, Motor Control Center, Well Building	Power failure	DI	
Microprocessor Metering Device, Main Incoming Switchgear	PSEG Voltage	AI (3)	Voltage on Phases A-B, B-C and A-C; Ethernet connection
Microprocessor Metering Device, Motor Control Center, Well Building	Well Building Operating Amps	AI (3)	Amps on each phase; Ethernet connection
Well Pump Motor Starter, Motor Control Center MCC-W	Well Pump On./Off Status	DI	Typ for each well
Well Pump Motor Starter, Motor Control Center MCC-W	Running Amps	AI	Typ for each well
pH Analyzer	pH Level	AI	
Chlorine Analyzer	Chlorine Level	AI	
Chemical Safety Panel, Well Pumps	Hypochlorite Pump On/Off Status	DI	Typ for each well
Chemical Safety Panel, Well Pumps	Well Pump Run safety satisfied	DI	Typ for each well
Chemical Safety Panel, Well Pumps	Pressure Switch Safety Satisfied	DI	Typ for each well
Chemical Safety Panel, Well Pumps	Chlorine safety satisfied	DI	Typ for each well
Chemical Safety Panel, Well Pumps	Limit Switch Safety Satisfied	DI	Typ for each well
Chemical Safety Panel, Booster Pumps	Lime Pump On/Off Status	DI	Typ for each booster pump
Chemical Safety Panel, Booster Pumps	Booster Pump Run safety satisfied	DI	Typ for each booster pump
Chemical Safety Panel, Booster Pumps	Limit Switch Safety Satisfied	DI	Typ for each booster pump

Device/Equipment	Description	Type	Remarks
Chemical Safety Panel, Booster Pumps	Flow Switch Safety satisfied	DI	Typ for each booster pump
Chemical Safety Panel, Booster Pumps	pH safety satisfied	DI	
Chemical Safety Panel, Booster Pumps	Limit Switch (Venturi) safety satisfied	DI	
Well Flow Indicating Transmitter	Well Flow	AI	Typ for each well
Booster Flow Indicating Transmitter	Booster Flow	AI	
Well Blowoff Valve Control Panel	Discharge Valve Open	DI	Typ for each well
Well Blowoff Valve Control Panel	Discharge Valve Closed	DI	Typ for each well
Well Blowoff Valve Control Panel	Blowoff Valve Open	DI	Typ for each well
Well Blowoff Valve Control Panel	Blowoff Valve Closed	DI	Typ for each well
Well Blowoff Valve Control Panel	Incomplete valve cycle	DI	Typ for each well
Security, Card Reader	Card Info/Data	AI	
Security, Key Switch	Enable/Disable Alarm	DI	
Magnetic Door Switches (Quantity of 5)	Door Entry	DI	
Magnetic Door Switches, Generator Walk-In Enclosure (Quantity of 4)	Door Entry	DI	

B. Packed Tower Aeration System Control Panel in Packed Tower Building

Device/Equipment	Description	Type	Remarks
Phase Failure Relay, Motor Control Center MCC-PT1	MCC-PT power failure	DI	
Microprocessor Metering Device, MCC-PT1	Voltage	AI (3)	Voltage on Phases A-B, B-C and A-C; Ethernet connection
Microprocessor Metering Device, MCC-PT1	Operating Amps	AI (3)	Amps on each phase; Ethernet connection
Booster Pump Variable Frequency Drive, MCC-PT1	Pump on/off status	DI	Typ for each booster pump
Booster Pump Variable Frequency Drive, MCC-PT1	Operating Speed	AI	Typ for each booster pump
Booster Pump Variable Frequency Drive, MCC-PT1	Running amps	AI	Typ for each booster pump
Transfer Pump Variable Frequency Drive, MCC-PT1	Pump on/off status	DI	Typ for each transfer pump
Transfer Pump Variable Frequency Drive, MCC-PT1	Operating Speed	AI	Typ for each transfer pump
Transfer Pump Variable Frequency Drive, MCC-PT1	Running amps	AI	Typ for each transfer pump
Blower Variable Frequency Drive, MCC-PT1	Pump on/off status	DI	Typ for each blower pump
Blower Variable Frequency Drive, MCC-PT1	Operating Speed	AI	Typ for each blower pump
Blower Variable Frequency Drive, MCC-PT1	Running amps	AI	Typ for each blower pump
Packed Tower Aeration System Control Panel	Well flow	AO	Via RTU (Typ for each well)
Packed Tower Aeration System Control Panel	Booster Flow	AO	Via Ethernet
Packed Tower Aeration System Control Panel	Clearwell Level	AI	Typ for each clearwell

Device/Equipment	Description	Type	Remarks
Packed Tower Aeration System Control Panel	Blower Safety, Low pressure	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Blower Safety, Low suction air flow	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Blower Safety, Low discharge air flow	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Blower motor starter safety fail	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Blower running unloaded	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Blower safeties satisfied	DI	Typ for each blower
Packed Tower Aeration System Control Panel	Clearwell High-High Level alarm	DI	
Packed Tower Aeration System Control Panel	Clearwell Low-Low level alarm	DI	
Security, Card Reader	Card Info/Data	AI	
Security, Key Switch	Enable/Disable Alarm	DI	
Magnetic Door Switches (Quantity of 3)	Door entry	DI	

PART 3 - EXECUTION

3.1 TESTS AND SERVICE

- A. After installation and prior to final acceptance, the SCADA system additions shall be placed into service for a continuous test period of five (5) days. During the test period, the SCADA System Supplier shall be available to assist the Owner in operating the new additions.
- B. Upon completion of the work, the manufacturer shall furnish the Engineer with certification that the equipment has been installed properly.

3.2 MAINTENANCE OF OPERATION

- A. The Owner's SCADA system shall remain in operation during the Work required herein.

3.3 RECORD DOCUMENTS

- A. The Owner shall be provided with a copy (hard copy plus electronic or CD) of the "As-built" wiring diagrams and software for the modified system.

+ + END OF SECTION + +

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SECTION 18440

WELL BLOWOFF VALVE CONTROL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals to furnish and install a Blowoff Control Panel for Well 7A and a Blowoff Control Panel for Well 8A (total of two [2] control panels).

B. Coordination:

Coordinate the Well Blowoff Valve Control Panel with the Packed Tower Aeration System Control Panel SCADA system provided under other sections, the well pump motor starter, discharge valve and blowoff valve.

C. Related Work Specified Elsewhere:

1. Section 18380, Packed Tower Aeration System Control Panel
2. Section 18420, SCADA System Additions and Upgrades.
3. Division 16, Electrical.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. NFPA 70, National Electrical Code.
2. Nassau County Department of Health.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified.

1. UL #508A, Standard for Industrial Control Panels.
2. NEMA Standards.

1.3 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted for approval prior to fabrication in accordance with the requirements of the Special Conditions of these specifications.
2. Shop drawings shall include physical arrangement of the control panels, internal details, wiring diagrams, control schematics, description of components and nameplate schedule.
3. Complete point-to-point wiring diagrams shall be provided.
4. Control schematics shall be referenced to a detailed written description of the functions of all switches, relays and time delays. Wiring diagrams will not be reviewed without this detailed functional description. Descriptions shall include, as applicable, but shall not be limited to the following:
 - a. Operation of the panel including the interfacing with auxiliary equipment.
 - b. Descriptions shall be complete and shall be the basis of instruction for operation and maintenance personnel.

B. Test Procedures:

The control panels shall be electrically and operationally tested at the factory in accordance with an approved test procedure. Certified test reports shall be submitted to the engineer prior to shipment to the job site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Control panel enclosure shall be rated NEMA 12, 20" wide by 30" high by 8" deep.
2. All lights, switches, indicators and other operable or visual components shall be mounted on the panel door and shall be grouped together in a logical fashion and shall be permanently labeled.
3. All points of connection to external wiring shall be wired by the vendor to a master terminal board with all wires and terminals being properly identified. Wiring diagrams shall be equivalent to NEMA Class II, Type C.
4. All indicating lights shall be heavy duty, oiltight, push-to-test. Lens color will be determined during shop drawing review.
5. All switches shall be heavy duty, oiltight. Contacts shall have NEMA A600 rating.
6. Control logic shall be relay-based. All relays shall be of the plug-in industrial control type. Contacts shall have NEMA A600 rating. Relays shall be provided with transient suppressors and coil indicating lights. Timer attachments for industrial relays shall be of the solid-state type. Number of contacts shall be as required.
7. All contact outputs shall be Form C, single pole double throw.

B. Well Blowoff Valve Control Panel

1. The controls shall operate on a 120 volt, single phase power supply.
2. There shall be a two position "Auto-Manual" switch and a three position Open-Stop-Close switch mounted on the control panel door to control blowoff operation. The blowoff piping has a motor operated valve which shall be controlled to change the valve position. There shall be a pressure sustaining valve on the well discharge piping to

the distribution system, which opens on rising head pressure after the blowoff valve has closed.

- a. When the switch is in the "Auto" position, the blowoff valve will be sequenced to the full open position allowing the well to pump to waste.
- b. When the switch is in the "Manual" position, the blowoff valve shall be controlled using the Open-Stop-Close switch.
- c. When the switch is in the "Automatic" position:
 - 1) The blowoff valve (and discharge valve) shall operate upon a timed sequence using the local Blowoff and Blowoff Safety timers mounted on the control panel door.
 - 2) Upon the call for well pump/blowoff sequence to start from the Packed Tower Aeration System Control Panel, the blowoff valve and discharge valve shall be sequenced to pump the well to waste for the amount of time set on the local Blowoff Timer. Once the Blowoff timer elapses, the blowoff valve and discharge valve shall be sequenced to pump the well to system.
 - 3) The blowoff valve operation shall be monitored using the Blowoff Safety timer. When the blowoff valve is called to transition, the blowoff safety timer shall be energized. If the blowoff and discharge valves fail to reach their commanded positions before the Blowoff Safety timer elapses, a valve failure condition will be tripped causing the well to be shutdown.
 - 4) The valve failure condition will be indicated by the "Valve Failure" pilot light mounted on the control panel. The valve failure condition shall require manual resetting using the local reset pushbutton mounted on the well pump motor starter door before the well can resume operation.

3. The controls shall include pilot lights for blowoff valve open and blowoff valve closed. These shall be based on the limit switch inputs from the blowoff valve.
4. The controls shall include pilot lights for discharge valve open and discharge valve closed. These shall be based on the limit switch inputs from the discharge valve.
5. Dry contact outputs for incomplete valve cycle, blowoff valve position (open and closed) and discharge valve position (open and closed) shall be provided for connection to both the SCADA RTU and Packed Tower Aeration System Control Panel.
6. Controls shall be integrated with the well pump motor starter in order that the well pump is shut down on incomplete valve cycle.
7. The controls shall be relay based. The blowoff timer and blowoff safety timer shall be digital as manufactured by IDEC, or approved equal.
8. Pilot lights, switches and timers shall be mounted to the face of the blowoff valve control panel.
9. The well blowoff and discharge valve controls including coordination with the well pump motor starter controls shall be furnished by the same manufacturer as the Packed Tower Aeration System Control Panel (Specification Section 18380).

2.2 PRODUCT AND MANUFACTURER

- A. The control panel shall be manufactured by the same manufacturer as the Packed Tower Aeration System Control Panel, Eagle Control Corp., or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Electrical Connections:
 1. All electrical connections from the control panels to the main power source and other appurtenant equipment shall be performed by the Contractor.

B. Protection During Construction:

1. The control panels shall be protected from moisture, dust and dirt both during storage and after installation for the entire construction period.

3.2 FIELD QUALITY CONTROL

A. Supervision:

1. The control panel manufacturer shall provide a service representative at the time of installation to inspect the completed installation and insure that all external wiring connections made by others are correct and shall so certify in writing to the Engineer. He shall make all final adjustments to place the equipment in proper operating order. He shall be available to visit the site and perform support services during the control panel testing period and complete testing period of the pumping system. He shall provide separate instructional services as specified herein.

B. Service:

1. Following installation, the Contractor shall coordinate with the vendor to furnish the services of a qualified operating and maintenance technician for start-up at the site to check and certify proper installation, and to demonstrate proper operation.

3.3 SPARE PARTS

A. The following spare parts shall be furnished:

1. 4 pilot light lamp bulbs.
2. 4 sets of fuses of each size and type.
3. One control transformer for each size and type.
4. 2 relays for each size and type.
5. 2 timers/time delay relays for each size and type.

B. Parts Lists:

Complete parts lists shall be provided for each item included in the control panel including a reference to a drawing number locating the specific part.

If the part is not of the Vendor's manufacture, he shall completely identify the name of the distributor (must be the local distributor not the distributor in the vendor's geographic area) address and phone number of this source of the equipment.

C. A price list for all parts shall be supplied.

3.4 MANUFACTURER TRAINING

- A. Following installation, the Contractor shall coordinate with the vendor to furnish the services of qualified factory trained specialists from the manufacturer to instruct the operations and maintenance personnel in the recommended operation and maintenance of this equipment. A minimum of two one-half days of instruction of personnel shall be included.

3.5 GUARANTEE

- A. All equipment shall be guaranteed against defects in material and workmanship for a minimum period of one year from the date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

+ + END OF SECTION + +

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SECTION 18460

DISINFECTION OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. Under this section, the Contractor shall furnish all labor, materials and equipment necessary to clean, flush and disinfect the packed towers, the clearwells, pumps and appurtenant piping, including conveyance of test water and all disposal thereof, and collect and analyze water samples for bacteriological and other criteria.

B. Related Work Specified Elsewhere:

1. Section 02667, Testing of Hydraulic Structures.
2. Section 03300, Cast-in-Place Concrete.
3. Section 18175, Disinfection.

1.2 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the work of this section:

- | | | |
|----|----------------|--|
| 1. | ANSI/AWWA B300 | Hypochlorites |
| 2. | ANSI/AWWA B301 | Liquid Chlorine |
| 3. | ANSI/AWWA C652 | Disinfection of Water-Storage Facilities |
| 4. | APHA/AWWA/WPCF | Standard Methods for the Examination of Water and Wastewater |

1.3 TESTING PLAN

- ###### A.
- The following shall be submitted in compliance with the shop drawing requirements of Section 01342:

1. A testing schedule, including proposed plans for water conveyance, control, disinfection, and disposal shall be submitted in writing for approval a minimum of 14 days before testing is to start. The submittal shall include the Contractor's plan for the release of water from structures after testing and disinfection has been completed.

PART 2 - PRODUCTS

2.1 MATERIALS REQUIREMENTS

- A. Temporary valves, bulkheads, or other water control equipment and materials shall be as determined by the Contractor. No materials shall be used which would be injurious to the structure or its future function.
- B. Chlorine for disinfection shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules. The tablet method shall not be permitted.
- C. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:
 1. In combination with appropriate gas flow chlorinators and ejectors.
 2. Under the direct supervision of an experienced technician.
 3. When appropriate safety practices are observed.
- D. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300.

PART 3 - EXECUTION

3.1 GENERAL

- A. All hydraulic structures for potable water storage, treatment and conveyance, and appurtenant pressure

piping for potable water shall be disinfected. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be done in the presence of the Engineer.

3.2 CLEANING AND PREPARATION

- A. After flushing the new piping, the walls, floor and ceiling of the clearwells and air stripping towers shall be thoroughly cleaned using a high pressure water jet or equally effective method. All water, dirt, and foreign material accumulated during the cleaning operation shall be removed prior to disinfection.
- B. The Work of this section shall be performed following the hydrostatic testing and repair of the clearwell structure and only after the testing procedure has been accomplished and accepted as passing successfully by the Engineer.

3.3 CHLORINATION

- A. The clearwells shall be filled to the overflow level with potable water to which enough chlorine is added to provide a free chlorine residual in the clearwell of not less than 10 mg/l at the end of a 24-hour period.
- B. Sodium hypochlorite shall be added to the water entering the clearwells by means of a chemical-feed pump, or shall be applied by hand-pouring into the clearwell and allowing the inflowing water to provide the desired mixing.
- C. When a chemical-feed pump is used, the concentrated chlorine solution shall be pumped through an appropriate solution tube so as to inject the high-concentration chlorine solution at a rate that will give a uniform chlorine concentration in the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the clearwell such that the chlorine solution will mix readily with the filling water.
- D. When the sodium hypochlorite is poured into the clearwell, the filling of the clearwell shall begin

immediately thereafter or as soon as any removed manhole covers can be closed. The sodium hypochlorite shall be poured into water in the clearwell when such water is not more than 3 feet in depth, nor less than 1 foot in depth.

- E. After clearwell 1 has been filled to the overflow level, the transfer pumps shall be activated. Chlorinated water shall be recirculated from clearwell 1 through the transfer pumps to the stripping tower and back into clearwell 1. The period of recirculation shall not be less than 24 hours.
- F. After clearwell 2 has been filled to the overflow level, the booster pumps shall be activated. Chlorinated water shall be recirculated from clearwell 2, through the booster pumps, to the stripping tower and back into clearwell 2. The period of recirculation shall not be less than 24 hours.
- G. After the 24-hour period has been satisfied, the free chlorine residual in the clearwell shall be reduced to a concentration of less than 0.05 ppm by completely draining the stripping system and refilling with potable water, until the chlorine residual is less than 0.05 ppm.

3.4 SAMPLING AND TESTING

- A. After the chlorination procedure is completed, and before the stripping system is placed into service, water from the facility shall be sampled and tested in accordance with the requirements of the Nassau County Health Department and as specified herein. The stripping system shall be shutdown overnight prior to sample collection.
- B. Sampling and testing shall conform to the following schedule. One sample shall be collected of raw and treated water for each analysis. All samples shall be taken from a sample tap on the discharge piping from the well pumps, the transfer pumps and the booster pumps. The operation shall be such as to ensure that the sample collected is actually from water that has been in the stripping system.

<u>Analysis</u>	<u>Sample Time After Startup (Minutes)</u>
Bacteriological*	0, 2, 5, 10, 30
Principal Organic Contaminants (POC) in accordance with Nassau County Department of Health requirements.	30
Inorganic Contaminants (IOC) in accordance with Nassau County Department of Health requirements.	30

* Bacteriological test shall be conducted 24 hours after disinfecting water has been flushed from the system.

3.5 BACTERIOLOGICAL

- A. If the test for coliform organisms is negative, then the Nassau County Department of Health (NCDH) shall conduct repeat tests.
- B. If the NCDH test for coliform organisms is negative, then the stripping system may be placed in service. If the test shows the presence of coliform bacteria, the disinfection and testing process shall be repeated at the expense of the Contractor until two consecutive negative samples are obtained.

+ + END OF SECTION + +

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SECTION 18470

WELL PUMP MOTOR STARTER CONTROL MODIFICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: The Contractor shall furnish and install all labor, materials and incidentals to modify the existing Well Pump Motor Starter Controls as described herein.

1.2 QUALITY ASSURANCE

- A. Control System Integrator:

1. In order to ensure standardization, proper interfacing and compatibility, it is required that the control system modifications be furnished by a single Control System Integrator who shall furnish and install all equipment and start-up services required for a proper installation, including related shop drawings.
2. The Control System Integrator shall have and maintain an adequate service organization located within 75 miles of the project site and shall be fully knowledgeable in the operation, maintenance, programming and installation of equipment required with a minimum of 10 years or applicable experience.
3. Control System Integrator shall be:
 - a. Eagle Control Corporation, Yaphank, NY (631-924-1315)
 - b. Or approved equal.

- B. Referenced Standards: The Contractor shall comply with applicable provisions and recommendations of the following:

1. National Electrical Code
2. Underwriters Laboratories, Inc.

3. Factory Mutual
4. National Electrical Manufacturer's Association
5. Occupational Safety and Health Act

1.3 SUBMITTALS

- A. Shop Drawings:
 1. Shop Drawings shall be submitted for approval prior to performing control system modifications.
 2. Shop Drawings shall include wiring diagrams showing modifications.
- B. As-Built Drawings
 1. As-built wiring diagrams shall be provided.

PART 2 - PRODUCTS

2.1 MODIFICATIONS TO WELL PUMP 7A AND 8A MOTOR STARTER CONTROLS

- A. Add Controls for Prelube Solenoid Valve: There will be a prelube solenoid valve for the pump. The control circuit shall open the prelube solenoid valve prior to the pump starting. The solenoid valve shall then close after a selectable time period.
- B. Interlock with Well Blowoff Valve Control Panel: Provide interlock to prevent the well from operating on "incomplete valve cycle."
- C. Provide relays as required for additional dry contact outputs to interface with SCADA and the Packed Tower Aeration System Control Panel.

2.2 CONTROL COMPONENTS

- A. Terminal blocks shall be provided for all remote connections.
- B. Control Relays: All control relays shall be miniature plug-in type with sealed clear plastic cases and

internal indicating pilot light for coil energized. Provide surge suppressers across all relay coils.

- C. Timers for Prelube Solenoid Valve: Timers shall be multi-function, digital setting type. Timers shall be IDEC GT3D-8, or approved equal.
- D. Pilot Lights: Push-to-Test, 120 volt, heavy duty oil-tight.
- E. Selector switches and pushbuttons: Industrial, heavy duty, oil-tight construction with clearly marked legend plates.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor and Control System Integrator shall survey each site to determine the "As-Built" aeration control systems and control modifications required by this work.

3.2 TESTS AND SERVICE

- A. After installation and prior to final acceptance, the aeration system control modifications shall be placed into service for a continuous test period of five (5) days. During the test period, the Control System Integrator shall be available to assist the Contractor and Owner if any problems arise.
- B. Upon completion of the work, the manufacturer shall furnish the Engineer with certification that the equipment has been installed properly.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18500

GAS FIRED UNIT HEATERS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: The Plumbing Contractor shall furnish all labor, materials, equipment and incidentals required to furnish and install natural gas fired unit heaters with accessories including all piping, valves and fittings, and mounting appurtenances as shown and required. This shall include furnishing and installing combustion air and exhaust vent ductwork.
- B. Related Work Specified Elsewhere:
 - 1. Section 09900, Painting
 - 2. Section 18002, Natural Gas Piping
 - 3. Section 18061, Steel Pipe
 - 4. Section 18068, Small Diameter Piping, Valves and Specials
 - 5. Division 16, Electrical

1.2 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
 - 1. Underwriters' Laboratories, Incorporated
 - 2. National Fire Protection Association
 - 3. National Grid/KeySpan Energy
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. Air Moving and Conditioning Association (AMCA).

2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
3. NFPA 54 - National Fuel Gas Code.
4. American National Standards Institute (ANSI)

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval Shop Drawings showing the following:
 1. Dimensions
 2. Capacities
 3. Materials of construction
 4. Finishes
 5. Manufacturer's literature, illustrations, specifications and engineering data.
 6. Wiring diagram showing all electrical interconnections.
 7. Layout of gas piping system, including all valves and appurtenances.
- B. Test Reports: Submit the following test certifications for approval.
 1. Fan to be tested as per AMCA standard 210 testing procedures.
 2. American Gas Association Certification.
 3. UL Label.
- C. Operation and Maintenance Manuals: Contractor shall furnish operation and maintenance manuals prepared by the manufacturers of all items of equipment furnished under this Section.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Unit heaters shall come completely assembled and protected.
2. Fuel supply and vent parts shall be protected against entry of foreign objects.

B. Storage of Material:

1. Store units in a clean, dry area, out of the weather.
2. Cap all pipe connections.
3. Units shall remain in crate until time of actual installation.
4. Units shall be tightly covered to protect against dirt, water, and mechanical or chemical damage.

1.5 COORDINATION

- A. The Plumbing Contractor shall furnish all labor, material and equipment to provide a gas line from the gas meter at each building to each gas unit heater.
- B. The Plumbing Contractor shall coordinate the installation with National Grid. The National Grid representative is Mr. Chet Singh (telephone number: 516-545-3876).
- C. All gas piping shall be installed and tested in accordance with National Grid gas requirements.
- D. The Plumbing Contractor shall be responsible for all National Grid charges and fees associated with this work.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. Casing:

1. Material: 22 Gauge Aluminized Steel, painted with a baked on powder paint 7-mil minimum thickness, for durability and corrosion resistance.
2. Mounting: Provide with hanger connections to accept 3/8"-16 threaded rods. Heaters shall be supported using stainless steel rods and hangers, allow 1" of top clearance.

B. Damp Environment (if applicable):

1. The unit heater shall be rated for use in 100% humidity, condensing.
2. A sealed compartment shall protect the gas valve, ignition, control, manifold, and burner from the environment.
3. Heaters shall be separated combustion type, which shall draw 100% of the combustion air from the outside.
4. The unit heater shall be rated to be durable in humid and heavy condensation environments, including areas that possess substances that would normally deteriorate the performance of the unit.
5. Burner: Burner shall be 409 Stainless Steel.

C. Heat Exchanger:

1. Construction: Completely machine welded with smoothly contoured stress free, air foil designed tubes.
2. Heat exchangers shall be 80% thermally efficient.
3. Damp Environment (if applicable): Heat Exchanger shall be 409 Stainless Steel.

D. Fan:

1. Type: Propeller
2. Dynamically balanced.
3. Finger proof fan guard.

E. Motors:

1. Type: Single speed.
2. Enclosure: Totally enclosed with built-in thermal overload protection
3. Mounting: Resilient mounted.
4. Bearings: Permanently lubricated.
5. Rating: 120 volt, single phase.
6. Produced, rated, and tested in accordance with NEMA standards.

E. Air Deflectors: Horizontal and vertical blades for complete directional control of air delivery.

F. Controls:

1. Each unit heater shall be equipped with a 115v/24v control step down transformer, a factory supplied terminal board for connection of low voltage thermostat and accessory field wiring, overheat control, 24v automatic gas valve, safety pilot with 100% shutoff, gas valve pressure regulator and electric fan timed delay relay. All controls shall be rated for a maximum inlet press of 1/2-psi gas pressure. The gas valve and fan timer shall be energized by the thermostat circuitry upon call for heat. The fan shall be energized on call for fan operation. Refer the wiring diagram included in the Electrical Construction Contract. The fan shall be delayed for approximately 30 seconds after main burner ignition. Controls shall be designed for natural gas having a specific gravity of 0.6, a BTU content of 1000 BTU/ft³ at 100 feet elevation.

2. The time delay relay shall also continue the air mover operation after the thermostat has been satisfied to remove any residual heat on the exchanger.
3. The control system shall be intermittent pilot ignition, 100% shutoff with continuous retry. Pilot shall be automatically lit on call for heat.
4. There shall be a high limit control switch that is mounted in the air stream and will shut off the gas supply in the event of overheating.
5. There shall be flame roll out switches mounted near the burners that will shut off the gas supply in the event of an unsafe flame roll out condition.

G. Thermostat:

1. Contractor shall furnish and install a single stage remote thermostat and all necessary connections for each unit heater. Switching range shall be 40-90 degrees F.
2. Thermostat shall be installed at an easily operable height and labeled to indicate unit heater controlled.
3. Thermostat shall be NEMA type 4X.
4. Thermostat shall be manufactured by Honeywell, or approved equal.

H. Spare Parts: Provide one can of 1-quart size touch up paint.

I. Unit Heater Schedule:

Wells 7A and 8A

Designation	Input Rating*	Motor Voltage	Manufacturer and Model Number
UH-5 (Pump Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal

Designation	Input Rating*	Motor Voltage	Manufacturer and Model Number
UH-7 (Pump Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal
UH-6 (Hallway)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal

Packed Tower Aeration Building

Designation	Input Rating*	Motor Voltage	Manufacturer and Model Number
UH-1 (Pump Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal
UH-2 (Tower Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal
UH-3 (Tower Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal
UH-4 (Pump Room)	30,000 BTU/Hr	120V, 1 ϕ	Modine HD-30, or approved equal

*Rating based upon the following criteria: Natural gas with a specific gravity of 0.6 and 1000 BTU/cubic feet heating value.

J. Manufacturer: Provide one of the following:

1. Modine Manufacturing Company,
2. Or approved equal

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect units for damage prior to installation and correction, if necessary, as recommended by manufacturers.

3.2 Installation

- A. Install unit heaters level and plumb utilizing air deflectors to direct air flow.

- B. Install units in accordance with details on the Drawings and approved Shop Drawings.
- C. Install in accordance with manufacturer's instructions.
- D. Install to NFPA 90A and ANSI/NFPA 90B.
- E. Install gas fired units to ANSI Z223.1 (NFPA 54).
- F. Confirm all required ventilation requirements are met. Inform Owner and Engineer if ventilation is not deemed adequate.
- G. Install unit heaters with vibration isolation.

3.3 CLEANING

- A. Clean tar, cement or other dirt from units.
- B. Remove debris and other waste material resulting from installation.

3.4 ADJUSTMENTS

- A. Set air deflectors for proper air delivery.
- B. Set thermostats for required setting.

3.5 STARTUP AND TESTING

- A. Unit heater manufacturer shall provide a manufacturer's representative to provide start-up supervision for the equipment and instruct the owner's personnel on the operating requirements of this equipment, for a minimum of one working day.

+ + END OF SECTION + +

SECTION 18600

VAPOR PHASE GRANULAR ACTIVATED CARBON OFF-GAS TREATMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

- 1 Under this section, the Contractor shall furnish all labor, materials and equipment necessary to provide a vapor phase granular activated carbon adsorption system suitable for treating air at 98% relative humidity and a flow rate of 22,460 cubic feet per minute. The system shall be composed of two box services modular treatment units, each capable of treating a flow of 11,230 cubic feet per minute.

B. Related Work Specified Elsewhere:

1. Section 09900, Painting
2. Division 18, Plumbing

1.2 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the work of this section:

1. ASME Section VIII, Division I - American Society of Mechanical Engineers Boiler and Pressure Vessel Code.
2. ASME/ANSI B16.5 American Society of Mechanical Engineers/American National Standards Institute.
3. Steel Structures Painting Council Surface Preparation Specifications and National Association of Corrosion Engineers.
4. ASME Section II, American Society of Mechanical Engineers - Materials, Parts A, B, & C.
5. ASTM American Society of Testing Materials.
6. American Water Works Association (AWWA) B604-90, standard for granular activated carbon.

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APPENDIX I - PIPING SCHEDULE

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**APPENDIX I
PIPING SCHEDULE**

ABBREVIATIONS

The following abbreviations are used.

A. Material Abbreviations

Copper	CU
Ductile Iron	DI
Polyvinyl Chloride	PVC
High Density Polyethylene Pipe	HDPE
Galvanized Steel	GALV
Black Steel	BS
Cast Iron Soil Pipe	CI

B. Interior Lining Abbreviations

Cement Lined	CL
--------------	----

C. Exterior Coating Abbreviations

Insulation	Insul.
Bituminous Coated	BC
Painted	P

D. Joint Abbreviations

Flanged	Flg
Screwed Fittings	S
Bell and Spigot	B&S
Mechanical Joint	MJ
Soldered	Sd
Flare	Flr.
Solvent Welded	SW
Bell and Plain End Adhesive Bonded	B&PE
Butt Welded	BW
Compression Fittings	C
Coupling Bands	CB
Thermal Butt Fused	BF

**APPENDIX I
PIPING SCHEDULE**

BURIED						
Service	Material	Interior Linings	Exterior Coating	Thickness Class	Joint	Pressure Test (psig)
Water Mains	DI	CL	BC	52	MJ ⁽¹⁾	125
Blowoff Mains	DI	CL	BC	52	MJ ⁽¹⁾	125
Water Services	Cu	-	-	Type K	C	125
Site Drainage Piping	HDPE	-	-	⁽³⁾	CB	-
Sampling Sink Drainage Piping	PVC	-	P	SCH 80	SW	10
Sampling Service	Cu	-	-	Type K	C	125
Venturi Pressure Sensing Services	Cu	-	-	Type K	C	125
Pressure Services Containment Piping	PVC	-	-	Sch. 80	SW	10
Blowoff Drain	Cu	-	-	Type K	C	125

EXPOSED						
Service	Material	Interior Linings	Exterior Coating	Thickness Class	Joint	Pressure Test (psig)
Water Mains (3-inch diameter and larger)	DI	CL	P	53	Flg	125
Water Service (less than 3-inch diameter)	Hard-drawn Cu	-	-	Type L	Sd	125
Air Release Vent	GALV	-	P	Sch. 40	S	10
Pump Head Drain	Hard-drawn Cu	-	-	Type L	Sd	10
Sodium Hypochlorite	Flexible PVC	-	-	⁽²⁾	-	10
Pump Lube Water	Hard-drawn Cu	-	-	Type L	Sd	10
Sampling Service	Hard-drawn Cu	-	-	Type L	Sd	125
Venturi Pressure Sensing Services	Hard-drawn Cu	-	-	Type L	Sd	10

⁽¹⁾With restrained joints and thrust blocks at all fittings.

⁽²⁾Refer to Section 18068.

⁽³⁾Refer to Section 18064.

+ + END OF SECTION + +

APPENDIX II - SOIL BORING LOG

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**SUBSOIL
INVESTIGATIONS**



SOIL MECHANICS DRILLING CORP.

3770 MERRICK ROAD • SEAFORD, L. I., NEW YORK 11783
(516) 221-2333 • FAX (516) 221-0254

June 26, 2014

D&B Engineers & Architects, P.C.
330 Crossways Park Drive
Woodbury, NY 11797
Att: Stephen J. Laun, P.E.

Re: Wells 7A & 8A
Levittown, NY
Our Job #14-408

Gentlemen:

Forwarded herewith are the boring logs for drilling work performed at the above referenced site.

The purpose of the subsurface investigation was to determine the nature and extent of the underlying soil deposits and determine the structural engineering characteristics of the soil at the site. Three (3) test borings were drilled to a depth of 20 feet each at the locations shown on our Boring Location Plan. Sample recovery was obtained using a CME automatic trip hammer and a standard 2 inch split spoon sampler. The number of blows required to advance the sampler each 6 inch increment were recorded and are shown on our boring logs, along with a written description of the recovered soil sample per our geologist's visual identification of. Continuous split spoon samples were taken for the top 6 feet then every 5 feet to the final depth.

The CME automatic hammer operates with an efficiency of approximately 90%. The original conventional use of rope, cathead and drop weight, on the other hand, operates with an efficiency of approximately 60%. As a consequence, the standard penetration test results obtained using the CME auto-hammer are on the order of two-thirds the value that would have been obtained had the original rope and cathead method been used. This is significant if you are using design charts for soil strength parameters based on historical data associated with the rope and cathead method. If so, you should adjust our data accordingly.

Our investigation revealed that the areas drilled are blanketed by 2-3 feet of loam and loose soil fill, underlain, generally, by a moderately dense naturally bedded fine to coarse sand formation with varying percentages of gravel and traces of silt extending to the deepest depth drilled.

No water, either natural or perched, was encountered within the boreholes at the time the work was done.

SOIL MECHANICS DRILLING CORP.

3770 MERRICK ROAD • SEAFORD, L. I., NEW YORK 11783
(516) 221-2333 • FAX (516) 221-0254

D&B Engineers & Architects, P.C.
Att: Stephen J. Laun, P.E.

June 26, 2014
Page 2

All soils below the loam and fill will satisfactorily support foundation loads of 3 tons per square foot and exhibit excellent drainage characteristics.

That natural soil has an in situ unit weight of 120 lbs/pcf.

The angle of internal friction of the natural sand is 34° .

The on-site sandy soils may be assumed to act as a fluid having equivalent fluid weights of 40 lb./cu.ft. active pressure, 55 lb./cu.ft. at rest and 350 lb./cu.ft. passive earth pressure.

Conventional spread and strip footings can be installed. We have not been apprised of the finished floor elevation; however, we recommend removal of the existing loam below the proposed slab on grade. If material needs to be placed for the new floor slab, we recommend free draining granular material with less than 10% passing a #200 sieve placed in 12 in. lifts and compacted to 95% of its Modified Proctor at optimum moisture content per ASTM D 1557.

Liquefaction is unlikely at this site and need not be a design consideration.

For seismic evaluation, the site is classified as Site Class "D" per the New York State Building Code.

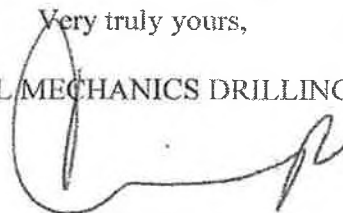
Soil samples recovered during drilling operations will be stored in our lab for a period of 30 days after which they will be destroyed. During this period we will deliver these samples to any prescribed location upon request.

If after you examine the enclosed you have any further questions, please feel free to call and discuss them with us.

Billing is enclosed.

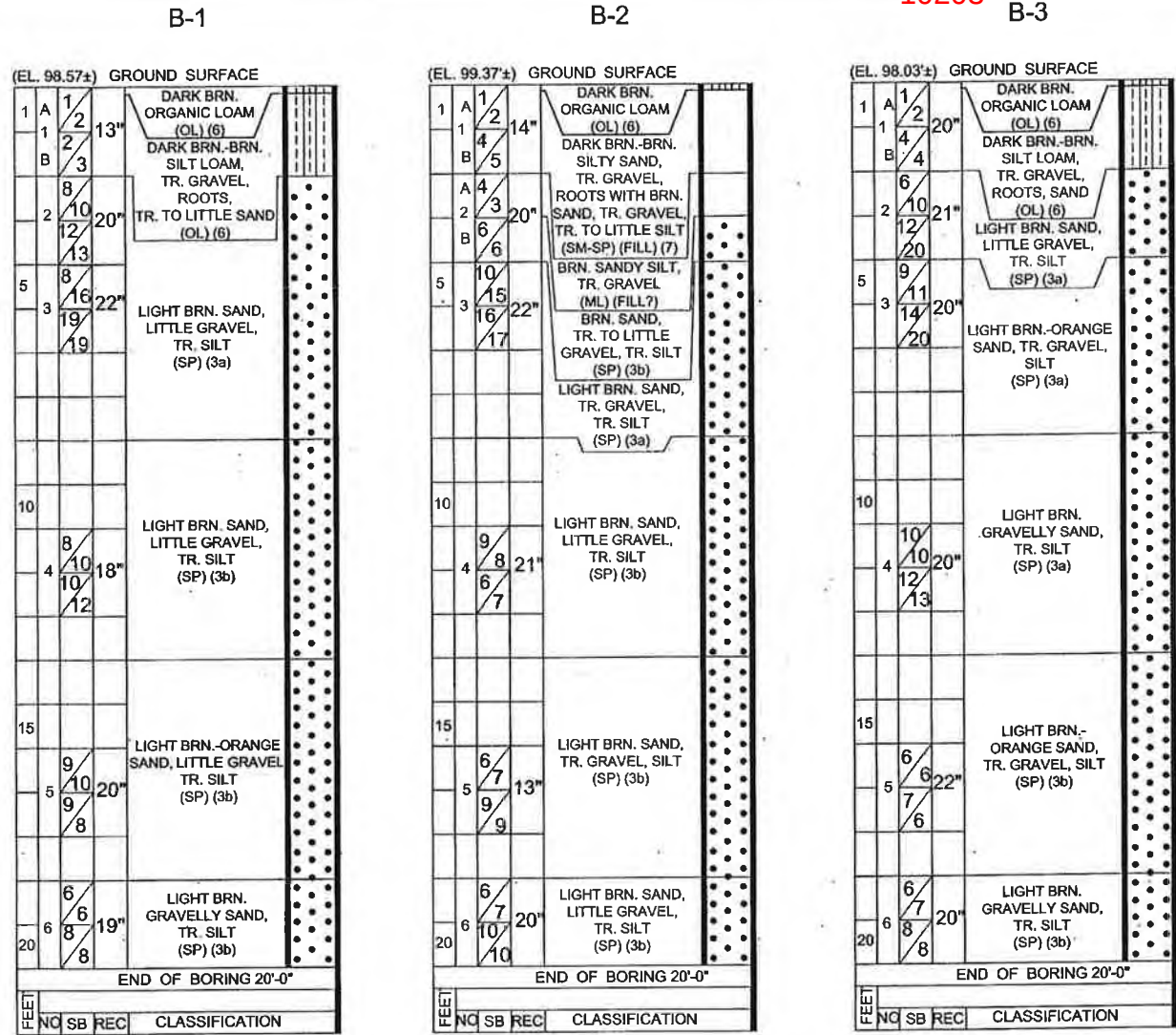
Very truly yours,

SOIL MECHANICS DRILLING CORP.



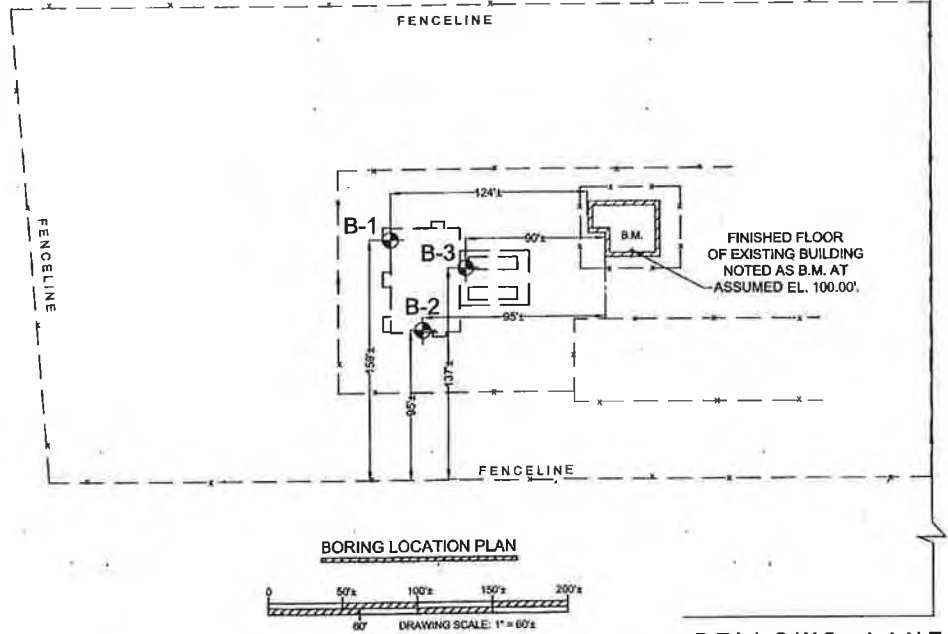
Carl Vernick, P.E.
President

CV:mlf
Encls.



NOTES

1. SOIL DESCRIPTIONS ARE BY VISUAL EXAMINATION OF SOIL SAMPLES RECOVERED DURING DRILLING OPERATIONS.
2. SOIL DESCRIPTIONS ARE IN ACCORD WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.
3. NO GROUND WATER TABLE WAS ENCOUNTERED TO THE LOWEST DEPTHS DRILLED.
4. SOIL STRATIFICATIONS ARE ACCURATE TO WITHIN TWO FEET VERTICALLY.
5. SOIL SAMPLES WERE OBTAINED USING A CENTRAL MINE EQUIPMENT (CME) AUTOMATIC TRIP HAMMER.
6. SOIL TEST BORING GROUND SURFACE ELEVATIONS SHOWN ARE REFERENCED TO FINISHED FLOOR OF EXISTING RESIDENCE AT ASSUMED B.M. EL. 100.00'.



UNIFIED SOIL CLASSIFICATION

SOIL GROUPS	TYPICAL NAMES AND SOIL SYMBOLS
1a Thru 1d	BED ROCK
GW	WELL GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OR NO FINES
GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURE
GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURE
SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
SM	SILTY SANDS, SAND - SILT MIXTURES
SC	CLAYEY SANDS, SAND - CLAY MIXTURES
ML	INORGANIC SILTS, VERY FINE SANDS, CLAYEY SILTS, SLIGHT PLASTICITY
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS
OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

ALLOWABLE SOIL BEARING PRESSURES, N.Y.C. BLDG. CODE TABLE 1804.1

CLASS OF MATERIALS (Notes 1 and 3) *	MAXIMUM ALLOWABLE FOUNDATION PRESSURE (TSF)	MAXIMUM ALLOWABLE FOUNDATION PRESSURE (KPA)
1. BEDROCK (NOTES 2 AND 7) *		
1a HARD SOUND ROCK - GNEISS, DIABASE, SCHIST	60	5,746
1b MEDIUM HARD ROCK - MARBLE, SERPENTINE	40	3,830
1c INTERMEDIATE ROCK - SHALE, SANDSTONE	20	1,915
1d SOFT ROCK - WEATHERED ROCK	5	765
2. SANDY GRAVEL & GRAVEL (GW, GP) (NOTES 3, 4, 8, AND 9) *		
2a DENSE	10	958
2b MEDIUM	6	575
3. GRANULAR SOILS (GC, GM, SW, SP, SM, & SC) (NOTES 4, 5, 8, AND 9) *		
3a DENSE	6	575
3b MEDIUM	3	287
4. CLAYS (SC, CL & CH) (NOTES 4, 6, 8, AND 9)		
4a HARD	5	479
4b STIFF	3	287
4c MEDIUM	2	192
5. SILTS & SILTY SOILS (ML & MH) (NOTES 4, 8, AND 9) *		
5a DENSE	3	287
5b MEDIUM	1.5	144
6. ORGANIC SILTS, ORGANIC CLAYS, PEATS, SOFT CLAYS, LOOSE GRANULAR SOILS, & VARIED SILTS	SEE 1804.2.1 *	SEE 1804.2.1 *
7. CONTROLLED & UNCONTROLLED FILLS	SEE 1804.2.2 OR 1804.2.3 *	SEE 1804.2.2 OR 1804.2.3 *

* REFER TO SECTION 1804.2 OR NOTES FOLLOWING TABLE 1804.1 IN THE N.Y.C. BLDG. CODE FOR ADDITIONAL INFORMATION

COMPACTION RELATED TO SPOON BLOWS PER FOOT

SAND & SILT		CLAY	
LOOSE	LESS THAN 10	SOFT	4 OR LESS
MEDIUM	10 TO 30	MEDIUM	GREATER THAN 8 TO 30
DENSE	GREATER THAN 31	HARD	GREATER THAN 30

"N" STANDARD PENETRATION TEST - ASTM 1586

2" SPOON, 140lb HAMMER @ 30" FALL

SPPOON BLOW COUNT IS GENERALLY SHOWN IN 6" INCREMENTS FOR 2' DRIVE

TO OBTAIN BLOWS PER FOOT (N) USE THE 2ND & 3RD 6" INCREMENT

	ROTARY CASING	EXTRA HEAVY CASING	SAMPLE SPOON
SIZES, INCHES	2.5		2.0
HAMMER WEIGHT, POUNDS			140
HAMMER FALL, INCHES			30

CB - CASING BLOWSPER 1 FOOT DRIVE
SB - SPOON BLOWS PER 6 INCH DRIVE
P - PUSHED BY WEIGHT OF HAMMER
WOR - WEIGHT OF ROD

UD - UNDISTURBED SOIL SAMPLE
NO - SAMPLE NUMBER
FEET - DEPTH FROM GND. SUR. NOTED AT EACH 5'
WOH - WEIGHT OF HAMMER
REC - SOIL RECOVERY IN INCHES

THE LIABILITY OF SOIL MECHANICS DRILLING CORP., ITS OFFICERS OR EMPLOYEES, FOR ERRORS, OMISSIONS OR NEGLIGENCE RESULTING IN PERSONAL INJURIES, PROPERTY DAMAGE OR ANY CONSEQUENTIAL DAMAGES, IS LIMITED TO THE AMOUNT OF THE FEE PAID FOR THIS REPORT. THE RETENTION OR USE OF ANY PART OF THIS REPORT WILL CONSTITUTE AN ACCEPTANCE OF THIS LIMITED LIABILITY. IF THIS IS UNACCEPTABLE, THE CLIENT MUST NOTIFY SOIL MECHANICS DRILLING CORP. IN WRITING BY CERTIFIED MAIL, WITHIN SEVEN DAYS FROM THE DATE OF RECEIPT. THE FEE CHARGED FOR THIS REPORT IS BASED ON THIS LIMITATION OF LIABILITY WHICH IS THE ESSENCE OF THIS AGREEMENT. IF THE CLIENT WANTS A HIGHER LIMITATION OF LIABILITY, SOIL MECHANICS DRILLING CORP. WILL NEGOTIATE ONE, BASED UPON A HIGHER FEE BEING CHARGED FOR THE ADDITIONAL ASSUMPTION OF LIABILITY. SOIL MECHANICS DRILLING CORP., ITS OFFICERS OR EMPLOYEES, HAVE NO LIABILITY OR RESPONSIBILITY TO PERSONS OTHER THAN THE CLIENT FOR WHOM THIS REPORT WAS PREPARED. ANYONE, OTHER THAN OUR CLIENT, RELIES ON THIS REPORT AT THEIR OWN RISK.

DVIRKA
and
BARTILUCCI
CONSULTING ENGINEERS
330 CROSSWAYS PARK DRIVE
WOODBURY, NEW YORK 11797

SOIL MECHANICS DRILLING CORP.
subsoil investigations
3770 MERRICK ROAD * SEAFORD, NEW YORK 11783 * 516 - 221-2333

SUBSURFACE INVESTIGATION
WELL 7A & 8A
BOWLING LANE & BELLOWS LANE
LEVITTOWN, NEW YORK

VERTICAL BORING SCALE:
1/2" = 1'-0" UNLESS NOTED OTHERWISE

DRAWING DATE
JUNE 23, 2014

DRAWING NUMBER
14R408.3

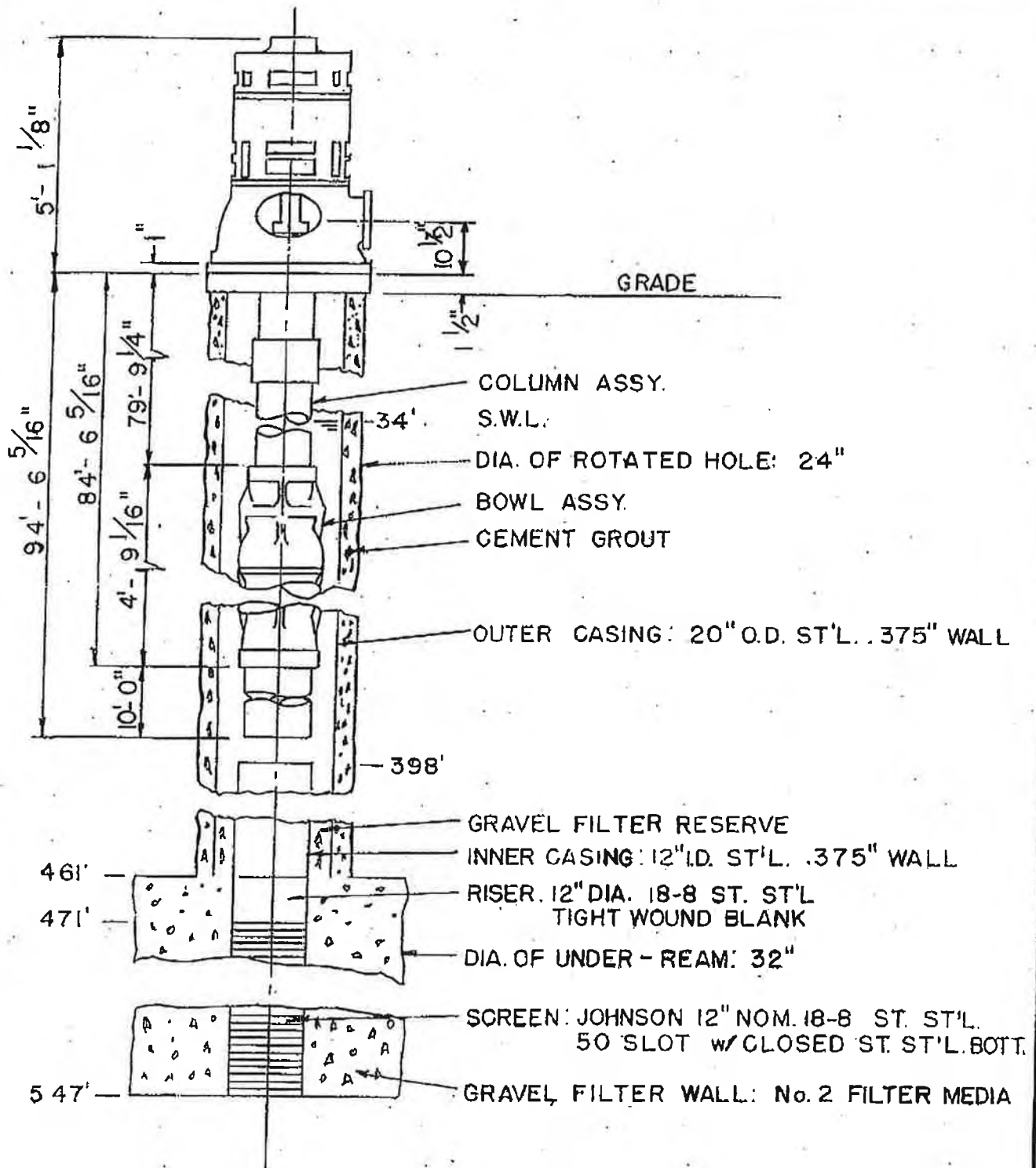
DATES OF BORING
JUNE 20, 2014

DRAWN BY: NAR
CHECKED BY: CV
REVISED DATE:

SHEET 1 OF 1

APPENDIX III - WELL LOG AND PUMP DATA

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LEVITTOWN WATER DISTRICT WELL 7A

THE LAUMAN CO.

C.W. LAUNAN & CO., INC.

Job 3-16 LEVITTOWN WATER DISTRICT
 Address WELL NO. 7A (N-8279)

Date 11-10-69

Pump: JOHNSTON

Desc: Reg'd. Rated

GPM 1400

Lift

Friction

Disch.

TDH 290'

Motor: Make U.S.

125 HP 230 Volts 3 Phase

1770 RPM Type Frame

Upper Bearing

Lower Bearing

Serial NRR

Gear Drive: JOHNSON

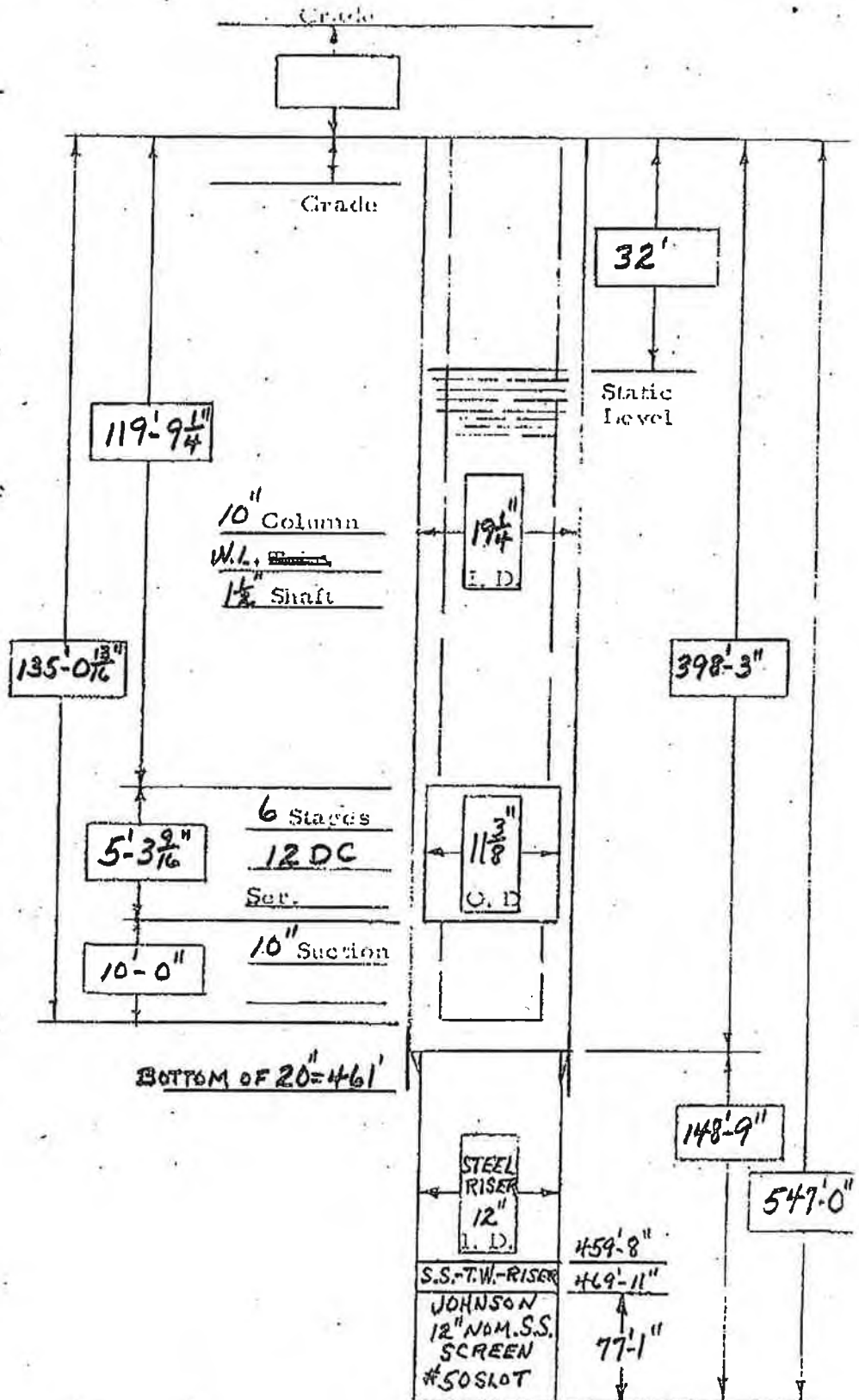
Serial

Model HE-150 Ratio 1:1

Air Line Length

Impellers: Dia.

Closed - 12 DC



JOHNSTON VERTICAL TURBINE PUMP

Well 7A

4 $\frac{1}{8}$ " DIA. HOLES

4 $\frac{1}{8}$ " DIA. HOLES ON $25\frac{1}{2}$ " D.C.

10" x 125" ASA DISCHARGE FLANGE

ODD BASE CAST IRON

CONDITIONS:

U.S. GALLONS PER MINUTE— 1200
TOTAL DYNAMIC HEAD IN FT— 225
LIQUID—
SPEC. GRAV. @ °F. TEMP.

U.S. ELECTRICAL - W/N.R.R.

VERTICAL HOLLOW SHAFT MOTOR

HP— 100 PHASE— 3 CYCLE— 60

VOLTAGE— 460 RPM— 1770

ENCLOSURE— WEATHER PROTECTED

THERMO-TECTORS

TYPE "A" DISCHARGE HEAD— $16\frac{1}{2}$ " x 10"

Air Line ?

COLUMN ASSEMBLY— 10" x $2\frac{1}{2}$ " x $1\frac{1}{2}$ "

EOWL ASSEMBLY— 5 STAGE 12 CS

18-8 S.S. PUMPSHAFT

10" SUCTION PIPE & CONE STRAINER— NONE

CUSTOMER LEVITTOWN W.D.— WELL #7A

PO#

DEALER THE LAUMAN CO., INC.

PO# 3-16-9950

JOHNSTON SERIAL NO. JZ-5126

JOHNSTON QUOTATION NO.

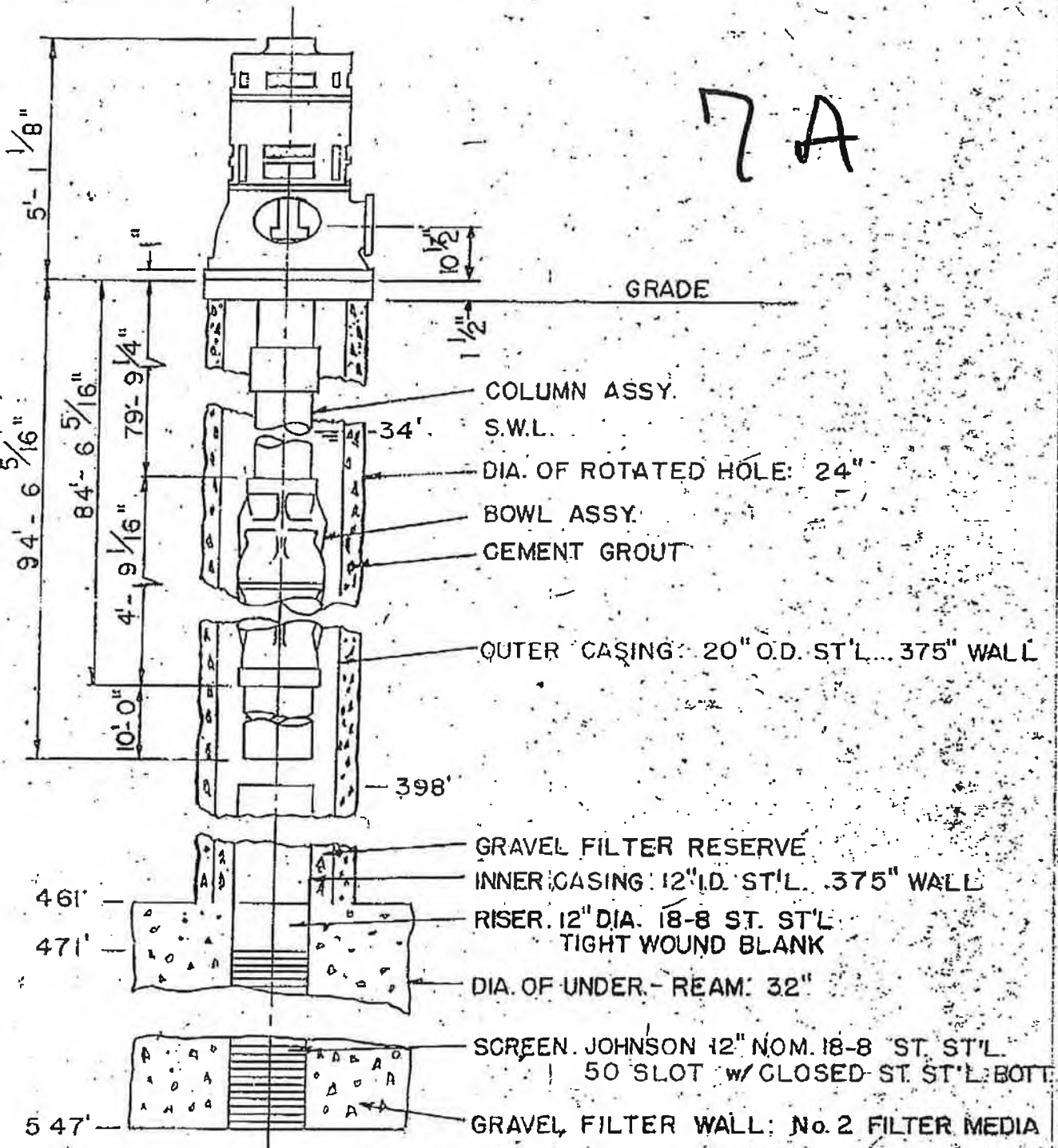
NOTE: DO NOT USE FOR CONSTRUCTION
UNLESS CERTIFIED

THE LAUMAN COMPANY, INC. THIS PRINT CERTIFIED
100 LAUMAN ST. CORRECT BY
BETH JOHNSTON PUMP COMPANY
Original Signed by
H. A. J. GREUTINK

JOHNSTON PUMP CO.
CLENDORA, CALIFORNIA

H-3100-A

7A



LEVITTOWN WATER DISTRICT WELL 7A

THE LAUMAN CO.

N- 8279

C. W. LAGUNA & CO., INC.

Job 3-16 LEVITTOWN WATER DISTRICT

Date 11-10-69

Address WELL NO. 7A (N-8279)

7A

Pump: JOHNSTON

Draw: Reg'd. Rated

GPM 1400

Lift

Friction

Disch.

TDM 290'

Motor: Make U.S.

125 HP 3 Phase

1770 RPM Type Frame

Upper Bearing

Lower Bearing

Serial NRR

Gear Drive: JOHNSON

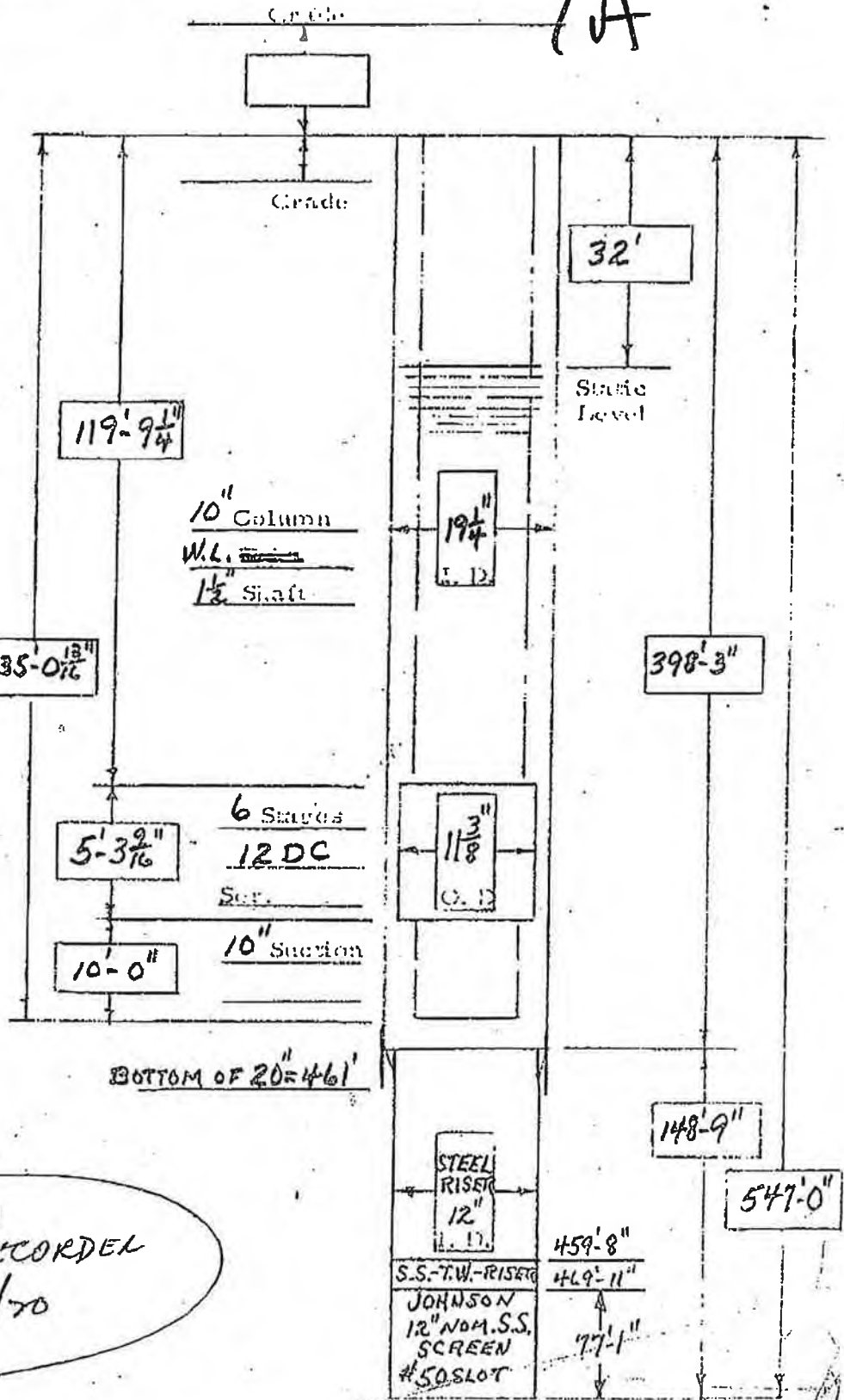
Serial

Model HE-150 Ratio 1:1

Air Line Length

Impellers: Dia.

Closed - 12 DC



#7A P.H. RECORD 7/70

C.W. BAUMAN & CO., INC.

J.B. 3-16 LEVITTOWN WATER DISTRICT

Date 11-10-69

Address WELL NO. 7A (N-8279)

7A

Pump: JOHNSTON

Box:	Reg'd.	Rated
GPM		1400
Eff.		
Friction		
Disch.		
TDM		290'

Motor: Make U.S.
 125 HP $\frac{230}{460}$ Volts 3 Phase
 1770 RPM Type Frame

Upper Bearing
 Lower Bearing
 Serial NRR

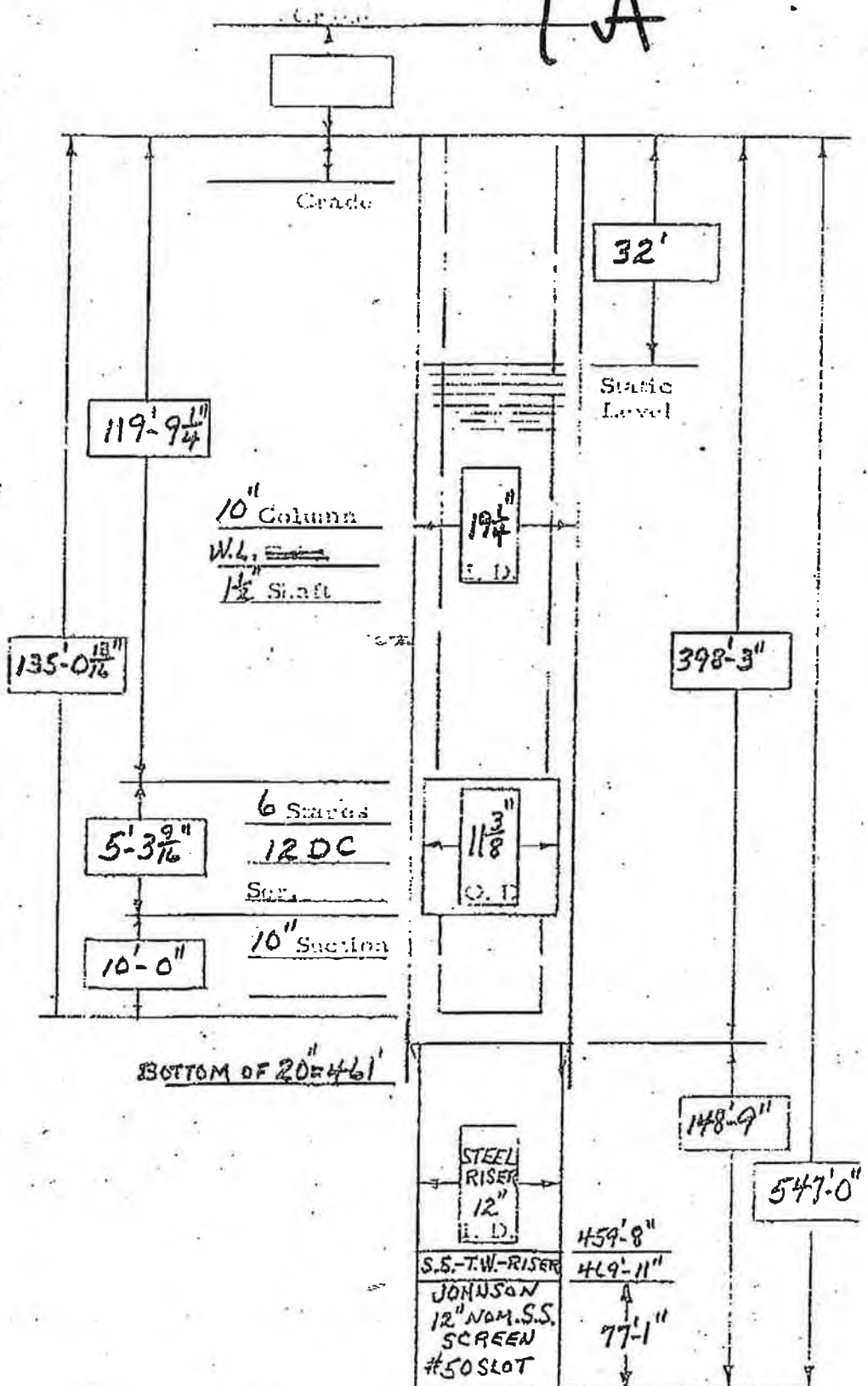
Gear Drive: JOHNSON

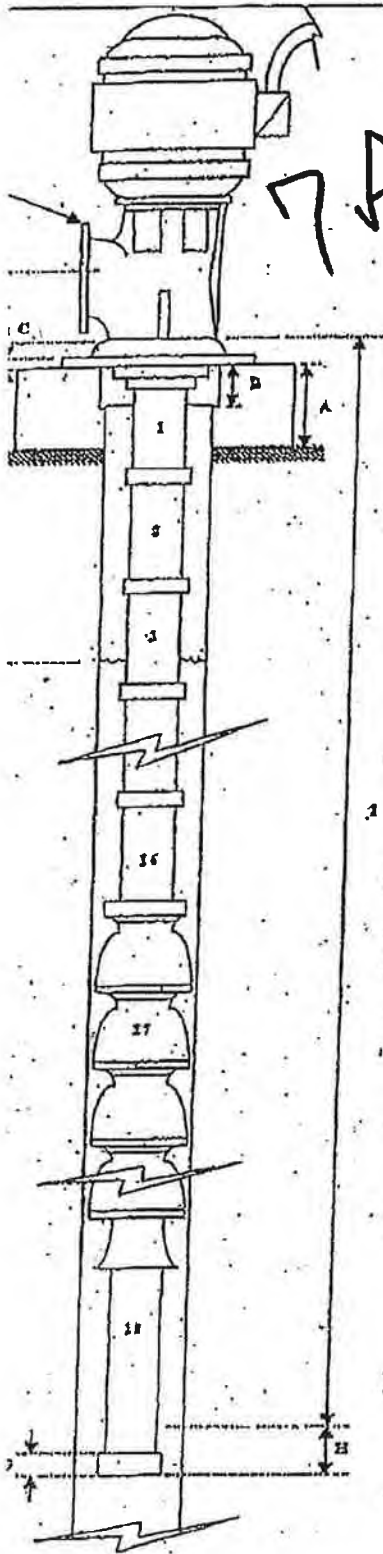
Serial
 Model HE-150 Ratio 1:1

Air Line Length

Impellers: Dia.

Closed - 12 DC





NOTES:

Levi Tower

Pump Station

Well No. 7A

Pull pump - Repair - Remittell

Contract No. _____

Project No. 1

Auth. No. _____

Motor Information	
Motor	Model No. _____
Serial No. _____	Phase <u>3</u> Cycles <u>60</u>
H.P. <u>100</u>	Amps _____ RPM _____
Volts _____	Frame _____ S.F. <u>1.15</u>
Type _____	Code _____ Ins. Class _____
Design _____	Lower Brg Sizes _____ Rating (C) _____
Upper Brg Sizes _____	N.R.R. _____ P.W.S. _____
Oil Cap. (Qtz) _____	175% E.H.T. _____ Enclosure <u>WPI</u>
Motor Clutch No. _____	F.L.P.F. _____ Max. KW/VAR _____
NEMA Nom Eff _____	

Sitting 120ft

Column Dia. 10"
(J&C)

Shaft Dia. 1 1/2"
(SS7)

1	5ft	Top Special
2	10' 0"	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12	5ft Bottom Sp	
13	13' 0" - 5' 8"	
14	13' 0" - 10' 8"	
15		
16		
17		
18		
<u>135' 8"</u>		Total Length of Pump

Well Measurements	
Total Depth	<u>547'</u>
Depth To Riser	<u>398'</u>
Casing Dia.	<u>20"</u>
Screen Dia.	<u>12"</u>
Riser or Packer?	<u>Riser</u>

Miscellaneous Measurements	
A: Pier Height	_____
B: Pier Cut-out Depth	_____
C: Grout Thickness	_____
D: Baseplate Thickness	_____
E: Fit to Top of BP	_____
F: Fit to Cntr of Ditch	_____
G: Thread Prot. Length	_____
H: Start of Airlines	_____
I: Airline Length	<u>120ft</u>
J: Ditch Head Fig OD	_____
K: Static Water Level	_____
Date:	_____

Pump Information	
Pump	Serial No. <u>157661</u>
No. Of Stages <u>5</u>	Size <u>13</u> Type <u>MC</u>
End Play <u>1200</u> GPM vs.	Impellers <u>Closed</u>
	<u>220'</u> TDH

Airline I.D. 1/4" Sillling Tube I.D. 5/8"
 Ditch. Head Size _____ Ditch. Pipe Dia. _____

Pump Set By: Eugene Costello
 Inspected By: _____

Company: Log Geo L & S
 Date: 2/29/10

NO TEXT ON THIS PAGE

8A

JOHNSTON VERTICAL TURBINE PUMP

See 8A

Approved _____
 Approved as noted _____
 Revise and resubmit _____

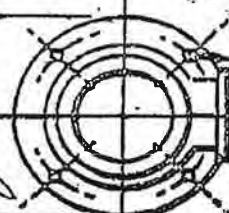
This approval applies to general design only and does not relieve the contractor of his responsibility for dimensions, quantities, construction and compliance with the Contract

Baldwin & Cornelius Co.

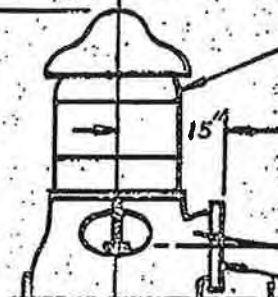
ROCKAWAY, N. Y.

FREEPORT, N. Y.

Date 3-30-65 By J. J. Baldwin



4 7/8" DIA. HOLES ON 25 1/2" B.C.

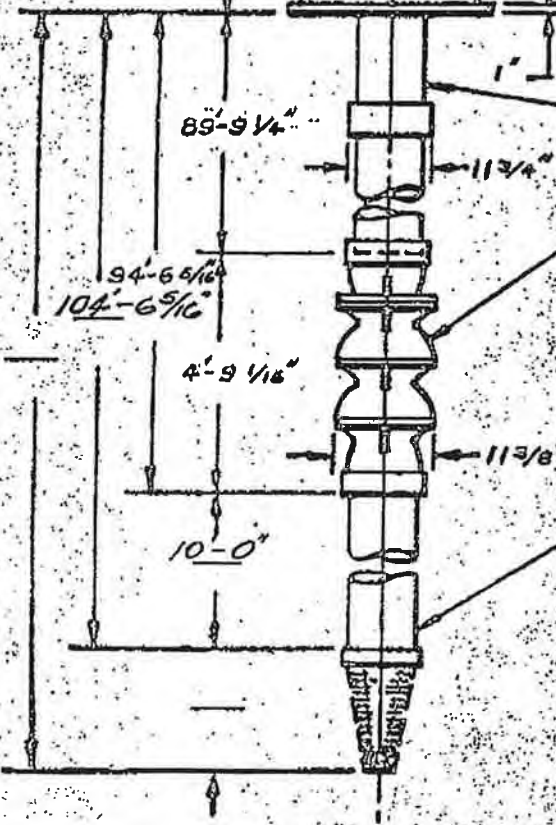


U.S. ELECTRICAL - W/ N.R.B.
 VERTICAL HOLLOW SHAFT MOTOR

100HP 3 PHASE 60 CYCLE
 220 VOLT 1800 RPM

DRIP-PROOF ENCLOSURE
 W/ THERMOPROTECTOR

16 1/2" x 10" TYPE "A" DISCHARGE HEAD
 10" X 125# FLANGE



10" x 2 1/2" x 1 1/4" COLUMN ASSEMBLY

5 STAGE 12CS BOWL ASSEMBLY

CONDITIONS:
 1200 USGPM
 228 FT. TOTAL HEAD
 LIQUID WATER
 SPEC. GRAV. 1.0 @ AMB° F PUMPING TEMP.

10" SUCCTION PIPE NO CONE STRAINER

CUSTOMER - LEVITTOWN WATER DIST. - WELL 8A

PO#

DEALER - G.W. LAUMAN & CO. INC.

PO# 87-3619

JOHNSTON SERIAL # JX-1098

JOHNSTON QUOTATION #

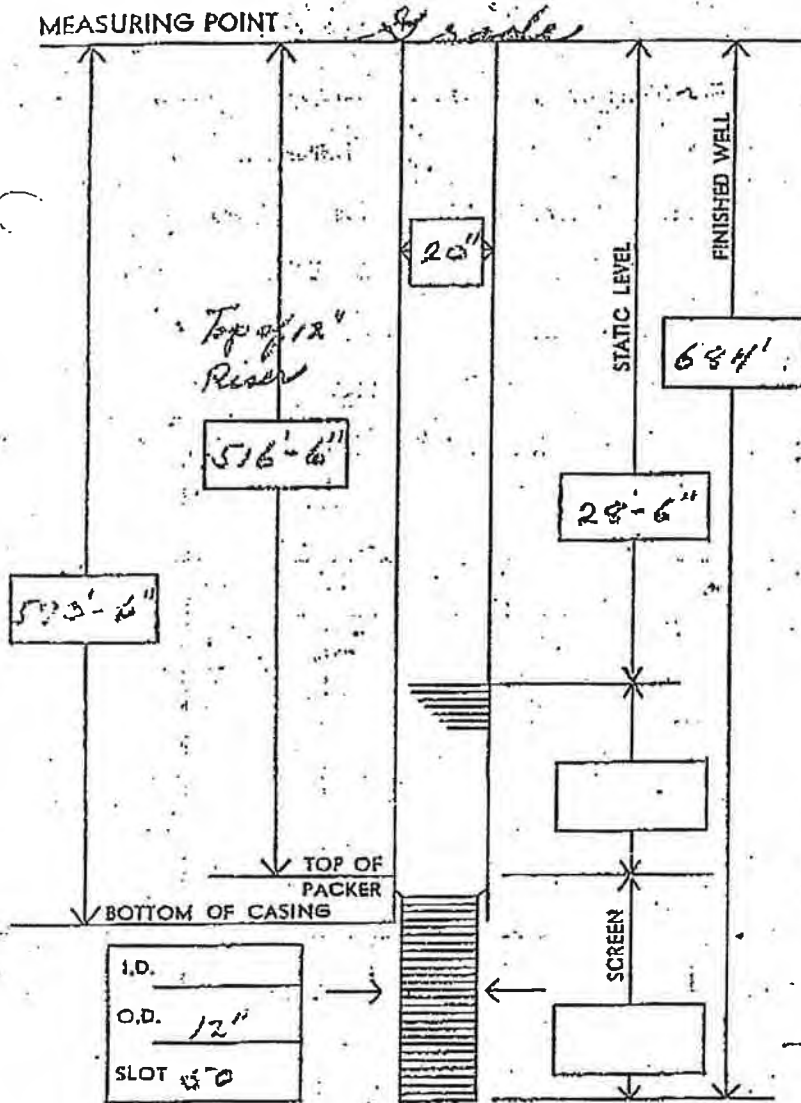
NOTE: DO NOT USE FOR CONSTRUCTION
 UNLESS CERTIFIED

THIS PRINT CERTIFIED
 CORRECT BY
 JOHNSTON PUMP COMPANY
 Original Signed by
 H. A. J. GREUTINK

Per

JOHNSTON PUMP COMPANY
 PASADENA, CALIFORNIA

H-1252-A



THE LAUMAN COMPANY, INC.
 100 LAUMAN LANE
 BETHPAGE, L.I., N.Y. 11714

Levittown Water Dist
Well #8A

SKETCH OF LOCATION



Show North Point

Locate well with respect to at least two streets or roads, showing distance from corner and front of lot.

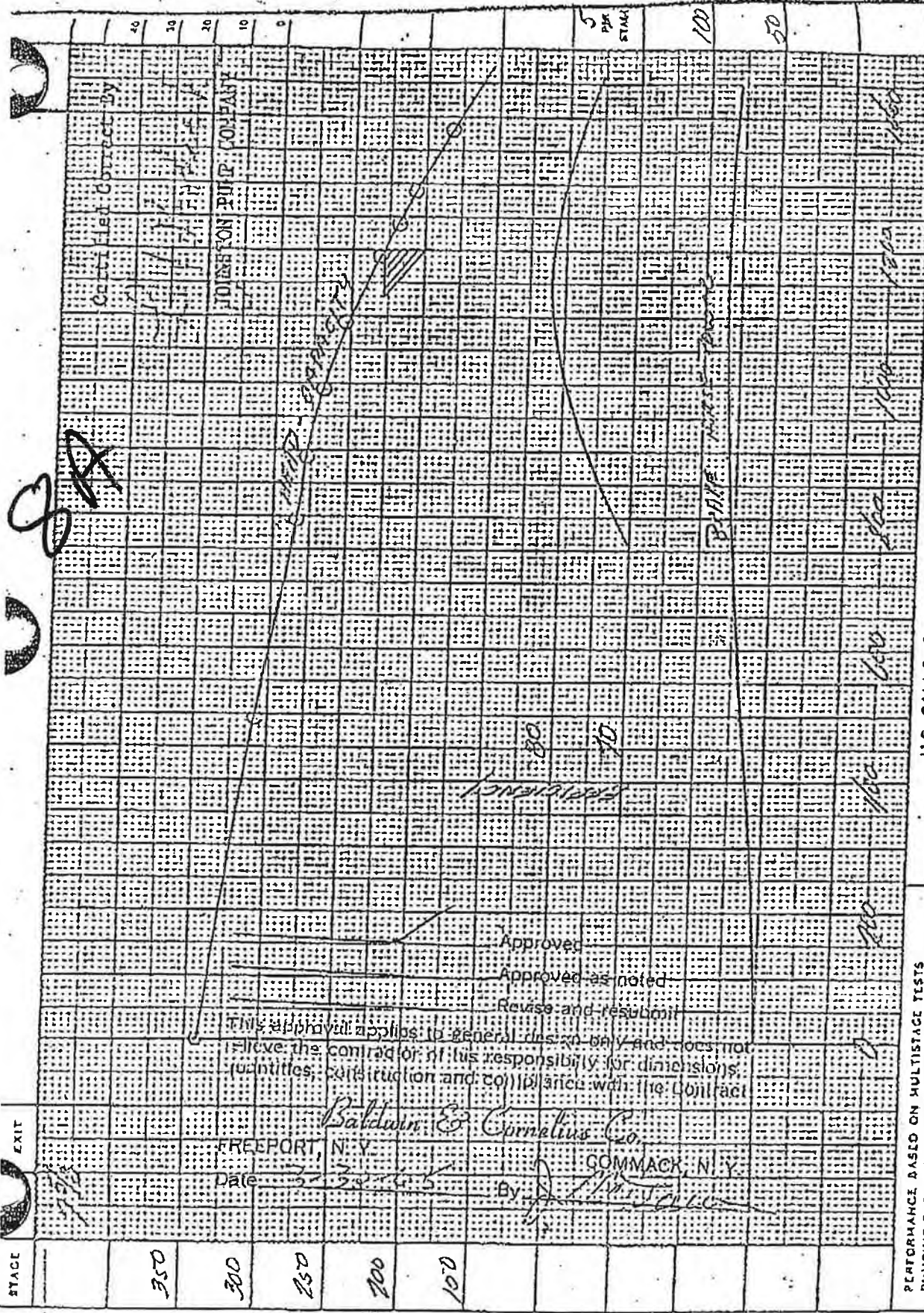
Type of Screen—

This is a 12" Johnson & Deere 77'-7" of 12" Johnson & Deere #50 slot 32" Dia Under reamed in screen zone.

FE—If outer casings are used state diameter, length and whether or not left in the ground.

FE—If screen is finished off with riser, give exact description of top of riser—(size and male or female thread.)

MARKS—0 - 590'-6" - 20" casing casing within 24" dia. Riser to top of 12" riser
 16'-6" - 579'-0" - 12" 12" riser
 17'-0" - 589'-2" - 12" Johnson & Deere
 9'-2" - 614'-9 1/2" - 12" Johnson & Deere #50 slot
 1'-9 1/2" - 632'-6" - 12" Johnson & Deere #50 slot
 1'-1/2" - 684' - 12" Johnson & Deere #50 slot
 of gravel 522' - Epper #3
 next gravel from 8' - 590'



JOHNSTON PUMP COMPANY

PASADENA, CALIFORNIA

PERFORMANCE BASED ON MULTISTAGE TESTS
 PUMPING CLEAR COLD WATER 50° OR 10°
 FOR 1 STAGE MULTIPLY HEAD & EFF BY
 FOR 2 STAGES MULTIPLY HD & EFF BY

APPROVED _____

APPROVED AS NOTED _____

REVISED AND RESUBMITTED _____

THIS APPROVAL APPLIES TO GENERAL DESIGN ONLY AND DOES NOT
 RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR DIMENSIONS,
 QUANTITIES, CONSTRUCTION AND COMPLETION WITH THE CONTRACT

DATE 3-28-65 BY J. J. J. J.

DATE 2-18-65

C.W. LAUMAN & CO., INC.

Job 8-7 Levittown Water District
 Address W. 22nd St. #8A

Date 3-25-65

Pump: Johnston

Disty	Reg'd.	Rated
GPM	1200	1200
Lift	64	
Friction	2	
Disch.	16.2	
TIDH	228	228

Motor: Make W.S.
100 HP 220 Volts 3 Phase
1770 RPM Type Frame

Upper Bearing
 Lower Bearing
 Serial NRR

Gear Drive: NONE
 Serial
 Model Ratio

Air Line Length 90'

Impellers: Dia.

Fixed

Semi-Open 12CS

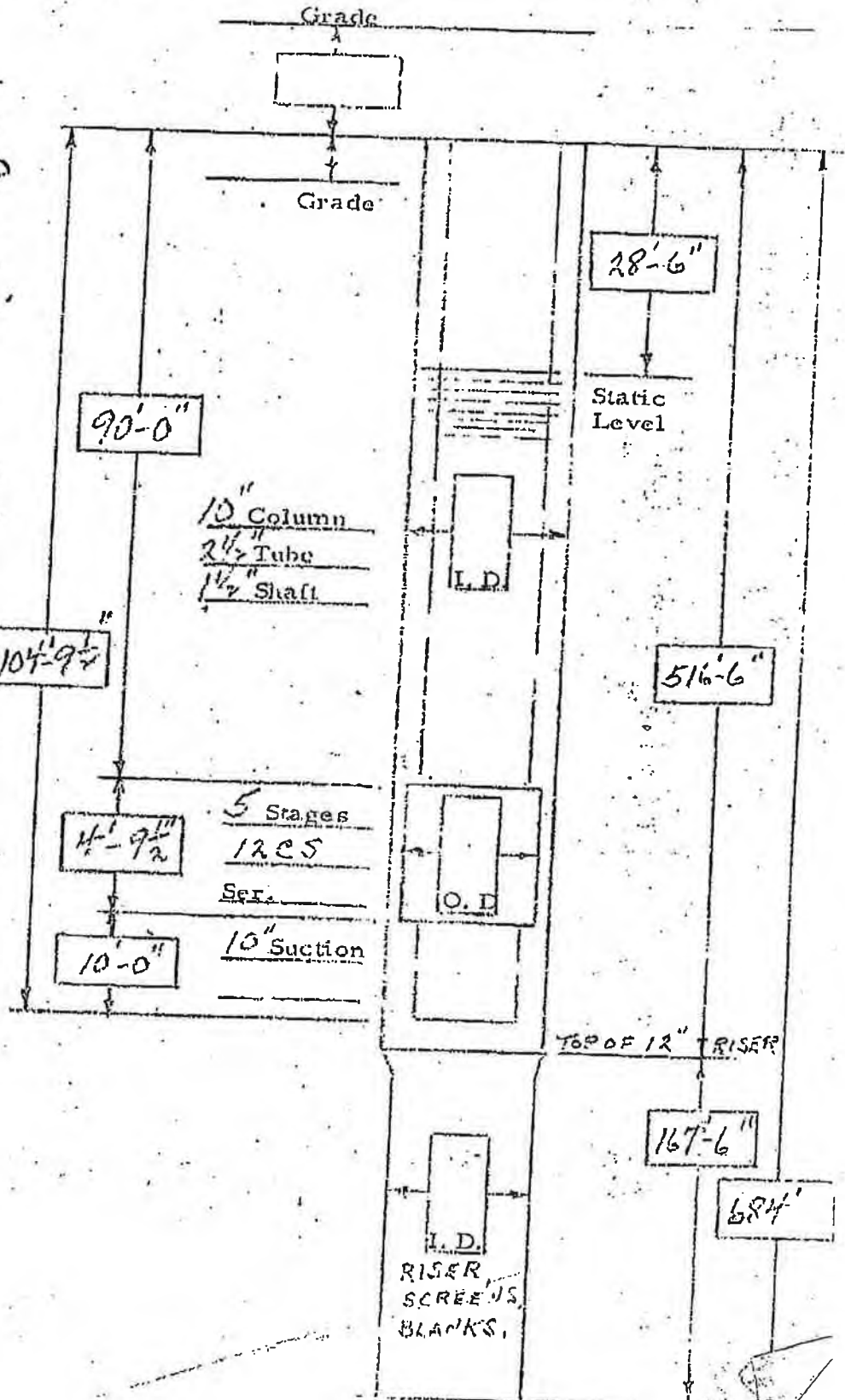
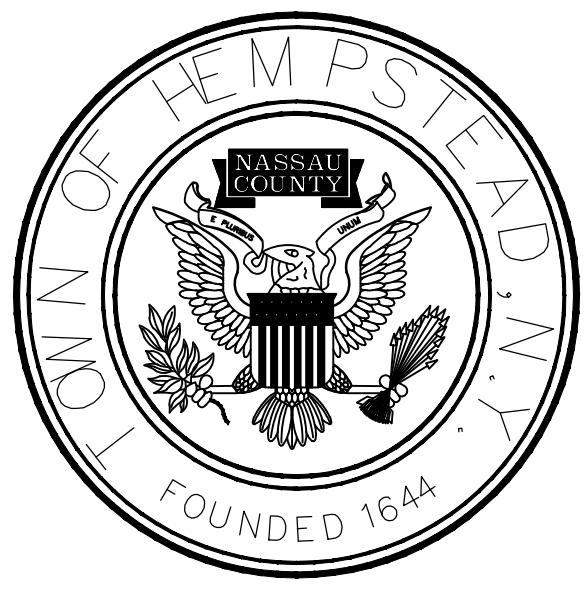


EXHIBIT F

TOWN OF HEMPSTEAD DEPARTMENT OF WATER

NASSAU COUNTY

NEW YORK



LEVITTOWN WATER DISTRICT

CONSTRUCTION OF PACKED TOWER AERATION SYSTEM

FOR WELL 13

GENERAL CONSTRUCTION - CONTRACT PW 46-14

PLUMBING CONSTRUCTION - CONTRACT PW 47-14

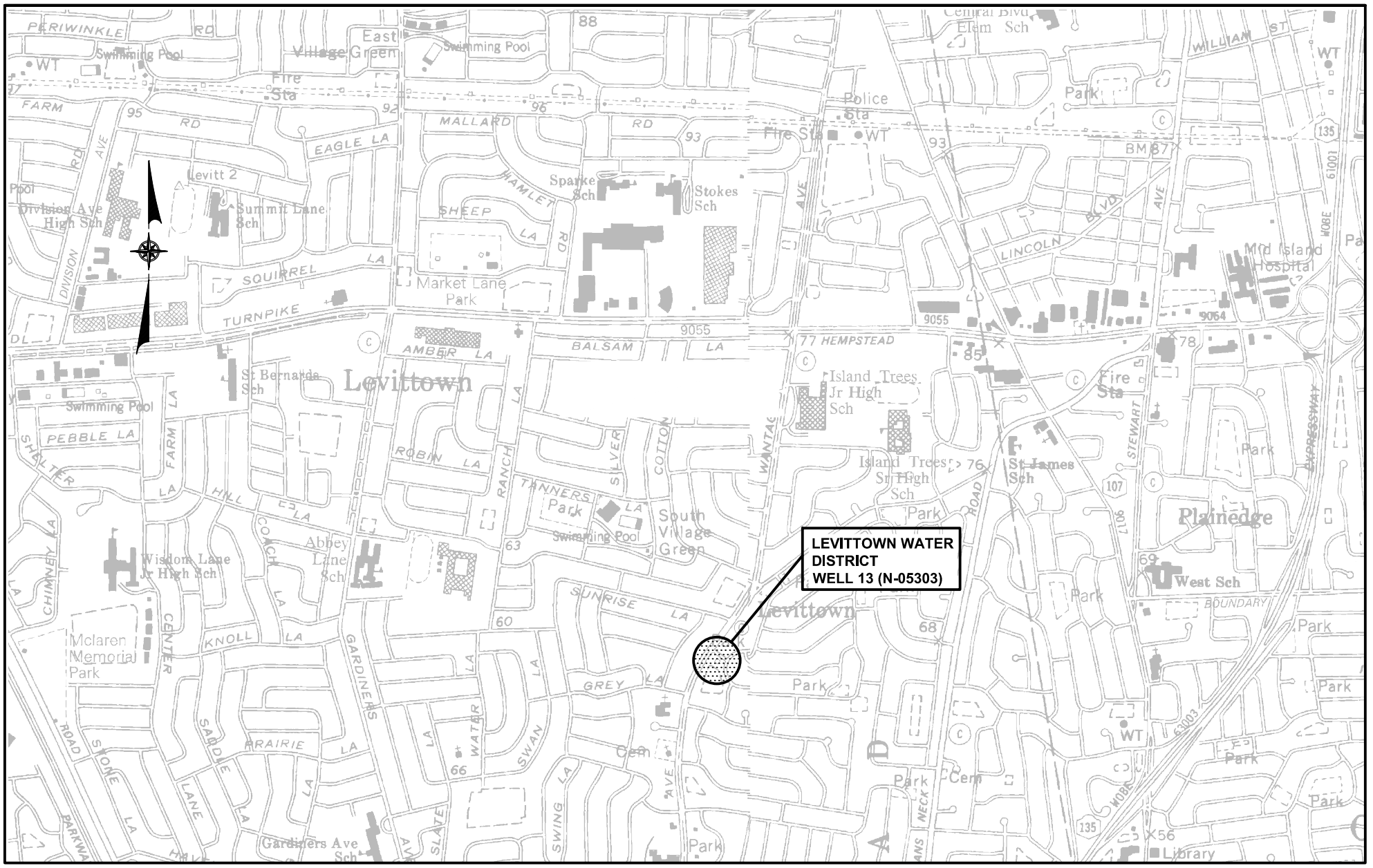
ELECTRICAL CONSTRUCTION - CONTRACT PW 48-14

NOVEMBER 2014

LIST OF DRAWINGS

GENERAL CONSTRUCTION

DWG. NO.	TITLE
-	GENERAL
	COVER SHEET
G1	SYMBOLS AND ABBREVIATIONS
G2	EXISTING/DEMOLITION & PROPOSED SITE PLANS
G3	SITE DETAILS I
G4	SITE DETAILS II
	ARCHITECTURAL
A1	PACKED TOWER BUILDING - NORTH AND EAST ELEVATIONS
A2	PACKED TOWER BUILDING - SOUTH AND WEST ELEVATIONS
A3	PACKED TOWER BUILDING - FLOOR PLAN
A4	PACKED TOWER BUILDING - DETAILS I
A5	PACKED TOWER BUILDING - DETAILS II
	STRUCTURAL
S1	GENERAL NOTES
S2	PACKED TOWER BUILDING - FOUNDATION PLAN
S3	PACKED TOWER BUILDING - SLAB PLAN AND SECTIONS
S4	PACKED TOWER BUILDING - ROOF FRAMING PLAN, SECTIONS AND DETAILS
S5	PACKED TOWER BUILDING - DETAILS
S6	GENERATOR ENCLOSURE-PLANS AND SECTIONS
	MECHANICAL
M1	FACILITY SCHEMATIC
M2	PACKED TOWER BUILDING - FLOOR PLAN
M3	PACKED TOWER BUILDING - SECTIONS 1 & 2
M4	PACKED TOWER BUILDING - SECTIONS 3 & 4
M5	WELL 13 BUILDING - EXISTING AND PROPOSED FLOOR PLAN
M6	PACKED TOWER BUILDING - DETAILS I
M7	PACKED TOWER BUILDING - DETAILS II



LOCATION MAP

N.T.S.

LIST OF DRAWINGS

ELECTRICAL CONSTRUCTION

DWG. NO.	TITLE
E1	DEMOLITION SITE PLAN
E2	WELL 13 BUILDING DEMOLITION FLOOR PLAN
E3	MOTOR CONTROL CENTER - ELEVATION AND SINGLE LINE DIAGRAM - DEMOLITION
E4	PROPOSED SITE PLAN
E5	WELL 13 BUILDING FLOOR PLAN
E6	PACKED TOWER BUILDING POWER PLAN
E7	PACKED TOWER BUILDING LIGHTING PLAN
E8	GENERATOR SET ENCLOSURE PLAN AND ELEVATIONS
E9	MOTOR CONTROL CENTERS MCC-W AND MCC-PT SINGLE LINE DIAGRAMS
E10	MOTOR CONTROL CENTER MCC-W AND MCC-PT ELEVATIONS
E11	CONTROL SYSTEM RISER DIAGRAMS
E12	WIRING DIAGRAMS I
E13	WIRING DIAGRAMS II AND MISCELLANEOUS DETAILS
E14	CONDUIT AND CABLE SCHEDULE AND PANELBOARD SCHEDULES
E15	LIGHTNING PROTECTION SYSTEM PLAN



db

D&B ENGINEERS
AND
ARCHITECTS, P.C.

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

ABBREVIATIONS

ADD'L	ADDITIONAL	HOA	HAND-OFF-AUTOMATIC SWITCH
AFF	ABOVE FINISHED FLOOR	HOF	HEAT-OFF-FAN SWITCH
ALUM	ALUMINUM	HDPE	HIGH DENSITY POLYETHYLENE
AIC	AMPERE INTERRUPTING CAPACITY	HP	HORSEPOWER
ARV	AIR RELEASE VALVE	ID	INSIDE DIAMETER
AT	ASTRONOMIC TIMER	INF	INFLUENT
Ⓢ	AT	INT	INTERIOR
&	AND	INV. EL./I.E.	INVERT ELEVATION
B,BOT	BOTTOM	IJ	ISOLATION JOINT
BLW	BLOWOFF	LBS. #	POUNDS
BM	BEAM	LF	LINEAR FEET
BP	BY PASS	LP	LOW POINT
BUTT.	BUTTERFLY VALVE	LS	LIMIT SWITCH
C.I.	CAST IRON	MLO	MAIN LUGS ONLY
CJ	CONSTRUCTION JOINT	MAX	MAXIMUM
C	CONDUIT	MECH	MECHANICAL
CL	CLEARANCE	MFTR	MANUFACTURER
Ⓢ	CENTERLINE	MIN	MINIMUM
CB	CIRCUIT BREAKER	MH	MANHOLE
C.O.	CLEAN OUT	MJ	MECHANICAL JOINT
COA	CLOSE-OPEN-AUTO- SELECTOR SWITCH	MO	MASONRY OPENING
CMU	CONCRETE MASONRY UNIT	MCC	MOTOR CONTROL CENTER
COL	COLUMN	NEC	NATIONAL ELECTRICAL CODE
CP	CONTROL PANEL	NO/#	NUMBER
CPT	CONTROL POWER TRANSFORMER	NC	NORMALLY CLOSED
CONC	CONCRETE	NO	NORMALLY OPEN
CONN	CONNECTION	NTS	NOT TO SCALE
CONT	CONTINUE,CONTINUOUS	OC	ON CENTER
C	CORROSION RESISTANT	OPNG	OPENING
CU	COPPER	OVR	OVERFLOW
D	DRAIN	P.E.	PLAIN END
DG	DRILL & GROUT	Ⓢ	PLATE/PROPERTY LINE
DET	DETAIL	PRESS.	PRESSURE
D.I./D.I.P.	DUCTILE IRON/D.I. PIPE	PS	PRESSURE SWITCH
DIS	DISCHARGE	PB	PULLBOX
DIA./ø	DIAMETER	PVC	POLYVINYL CHLORIDE PIPE
DPI	DIFFERENTIAL PRESSURE INDICATOR	RCP	REINFORCED CONCRETE PIPE
DPS	DIFFERENTIAL PRESSURE SWITCH	REC	RECIRCULATION
DWG(S)	DRAWING(S)	RED	REDUCER
DWLS	DOWELS	REINF	REINFORCE, REINFORCING
DS	DOOR MOUNTED SWITCH(INTRUSION ALARM)	REQ'D	REQUIRED
EXIST.	EXISTING	RPZ	REDUCED PRESSURE BACKFLOW PREVENTER
EA	EACH	RVSS	REDUCED VOLTAGE SOLID STATE STARTER
EC	ELECTRICAL CONTRACTOR	S	SANITARY
EE	EACH END	SCH	SCHEDULE
EF	EACH FACE	SP	SUMP PUMP DISCHARGE
EL,ELEV	ELEVATION	SPECS	SPECIFICATIONS
EQ	ELECTRICAL HANDHOLE	SQ.	SQUARE
EQUIP	ELECTRICAL MANHOLE	SQ. FT.	SQUARE FEET
ES	ELECTRIC UNIT HEATER	STN. STL.	STAINLESS STEEL
EW	ELECTRIC WATER HEATER	STD	STANDARD
EQ	EQUAL	STRUCT	STRUCTURAL
EQUIP	EQUIPMENT	SV	SOLENOID VALVE
ES	EACH SIDE	SUC	SUCTION
ETC	ET CETERA	TB	TERMINAL BOX
EW	EACH WAY	TD	TIME DELAY RELAY
EJ	EXPANSION JOINT	TC	TIME DELAY CLOSE
EXP	EXPANSION	TO	TIME DELAY OPEN
EXT	EXTERIOR	THERM	THERMOSTAT
X	EXPLOSION PROOF	T	TOP
FO	FAIL OPEN	T&B	TOP AND BOTTOM
FBO	FURNISHED BY OTHERS	TOS	TOP OF STEEL
FDN	FOUNDATION	TOW	TOP OF WALL
F.F./FIN. FL.	FINISHED FLOOR	TS	TRANSFER SWITCH
FL	FLOOR	TYP	TYPICAL
FRP	FIBERGLASS REINFORCED PLASTIC	U.N.O.	UNLESS OTHERWISE NOTED
FI	FLOW INDICATOR	UPS	UNINTERRUPTIBLE POWER SUPPLY
F	FLOW SWITCH	V	VENT
FS	FLOAT SWITCH	VIF	VERIFY IN FIELD
FTG	FOOTING	VERT,V	VERTICAL
FR	FRACTIONAL HORSEPOWER	W/	WITH
FVNR	FULL VOLTAGE NON-REVERSING STARTER	WS	WATER SERVICE
GALV	GALVANIZED	WWF	WELDED WIRE FABRIC
GC	GENERAL CONTRACTOR	WP	WEATHER-PROOF
GS	GALVANIZED STEEL		
GFI	GROUND FAULT CIRCUIT INTERRUPTER		

CIVIL

	E	EXISTING ELECTRICAL CONDUIT
	E	NEW ELECTRICAL CONDUIT
	G	EXISTING GAS MAIN
	G	NEW GAS MAIN
	S	SANITARY SEWER
	D	EXISTING DRAIN
	D	NEW DRAIN
	T	EXISTING TELEPHONE
	T	NEW TELEPHONE
	W	EXISTING WATER MAIN
	W	NEW WATER MAIN
	WS	NEW WATER SERVICE
	WS	NEW WATER SERVICE
	FD	FIBER OPTIC
	R	PROPERTY LINE
	X	NEW CHAIN LINK FENCE
	X	EXISTING CHAIN LINK FENCE
	18"	TREE TRUNK DIAMETER
	BM	BENCH MARK
	B-1	SOIL BORING AND NUMBER
	E	ELECTRIC MANHOLE
	S	SANITARY MANHOLE
	T	TELEPHONE MANHOLE
	D	DRAINAGE MANHOLE
		FIRE HYDRANT/WALL HYDRANT
		UTILITY POLE
	10.00	NEW SPOT ELEVATION

CIVIL EXISTING

	+10.00	SPOT ELEVATION
	108.00 TC	TOP OF CURB ELEVATION
	107.50 BC	BOTTOM OF CURB ELEVATION
		TREE
		TREE (EVERGREEN)
		VEGETATION LINE (HEDGES, LARGE SHRUBS, ETC.)
		UTILITY POLE
		LIGHT POLE
	#75	HOUSE NUMBER
		SIGN
		GAS VALVE
		GAS METER
		WATER VALVE
		WATER METER
		HYDRANT
		STORM DRAIN MANHOLE
		DRAINAGE INLET
		CATCH BASIN
		SANITARY SEWER MANHOLE
		ELECTRICAL MANHOLE
		TELEPHONE MANHOLE
		OTHER MANHOLE
		TRAFFIC CONTROL BOX

ARCHITECTURAL/STRUCTURAL

	EXISTING
	EXISTING TO BE REMOVED (SEE NOTE 2)
	NEW
	NEW (HIDDEN)
	NEW CONCRETE
	NEW BLOCK
	GRATING
	EARTH
	NEW CONCRETE (SITE PLANS ONLY)
	NEW PAVEMENT (SITE PLANS ONLY)

MECHANICAL/PLUMBING

	AIR RELEASE VALVE
	GATE VALVE
	BACK PRESSURE CONTROL VALVE
	BALL VALVE
	BUTTERFLY VALVE
	BUTTERFLY VALVE W/MOTORIZED ACTUATOR
	PLUG VALVE
	CHECK VALVE
	SOLENOID VALVE ASSEMBLY
	VENTURI METER
	FLANGED FITTING
	MECHANICAL JOINT FITTING
	UNION
	FLOW SWITCH, FLOW INDICATOR
	PRESSURE SWITCH
	FLOW TRANSMITTER
	CORPORATION STOP/SERVICE CONNECTION
	WATER METER
	LIMIT SWITCH
	PRESSURE GAUGE
	HOSE BIBB
	FLOAT SWITCH
	AIR FILTER
	INTAKE LOUVER
	BACKDRAFT DAMPER
	RPZ-BACKFLOW PREVENTER
	AIR FLOW MEASURING STATION

VENTILATION

	24"x 12"	SECTION DUCT SIZE FIRST DIMENSION IS HORIZONTAL
	12"x 24"	ELEVATION OF DUCT SIZE - FIRST DIMENSION IS SIDE SHOWN
	24"x 12"	PLAN OF DUCT SIZE - FIRST DIMENSION IS SIDE SHOWN
		VENTILATION DUCT TURN UP / TURN DOWN RESPECTIVELY
		FLEXIBLE CONNECTION

ELECTRICAL

	480V NON-FUSED DISCONNECT SWITCH (a INDICATES SWITCH RATING IN AMPS)
	COMBINATION MOTOR STARTER
	SINGLE PHASE MOTOR STARTING SWITCH WITH TERMINAL OVERLOAD
	WALL BATTERY PACK - 2 LAMP FIXTURE. SEE SPECIFICATION FOR LIGHTING FIXTURE SCHEDULE
	LIGHTING FIXTURE (UPPER CASE LETTER INDICATES TYPE, LOWER CASE LETTER INDICATES RESPECTIVE SWITCH, NUMERAL INDICATES CIRCUIT NUMBER) SEE SPECIFICATION FOR LIGHTING FIXTURE SCHEDULE
	DEVICE(SEE ABBREVIATIONS FOR TYPE)
	208Y/120V UTILITY PANEL
	HOME RUN TO PANELBOARD LETTERS AND NUMERALS INDICATE PANEL AND CIRCUIT NUMBER
	INDICATES WIRE AND CONDUIT RUN (SEE CONDUIT AND CABLE SCHEDULE)
	GROUND CABLE
	CONDUIT AND WIRING RUN EXPOSED
	CONDUIT CONCEALED OR BURIED
	CONDUIT (TURNED UP)
	CONDUIT (TURNED DOWN)
	CONDUIT FOR TELEPHONE SYSTEM
	LIMIT SWITCH
	FLOW SWITCH
	CAPPED CONDUIT (EXPOSED)
	JUNCTION BOX
	SWITCH(LOWER CASE LETTER INDICATES FIXTURES & EQUIPMENT TO BE SWITCHED) (REFER TO SPECIFICATION FOR RATINGS)
	THREE-WAY SWITCH(LOWER CASE LETTER INDICATES FIXTURES AND EQUIPMENT TO BE SWITCHED)(REFER TO SPECIFICATION FOR RATINGS).

MISCELLANEOUS SYMBOLS

	SECTION NO./ DETAIL LETTER
	DRAWING NO. ON WHICH SECTION / DETAIL IS SHOWN
	DRAWING NO. ON WHICH SECTION / DETAIL IS TAKEN
	EXISTING INDICATES EXISTING BUILDINGS, STRUCTURES AND FEATURES, ETC.
	PROPOSED INDICATES PROPOSED BUILDINGS, STRUCTURES AND FEATURES, ETC.

ELECTRICAL (CONTINUED)

	DUPLEX RECEPTACLE, 2 POLE,3 WIRE,120V,20A, 18" A.F.F. UNLESS OTHERWISE NOTED
	GRD FAULT CIRCUIT INTERRUPTER DUPLEX RECEPTACLE, 2 POLE 3 WIRE, 120V,20A,18" A.F.F. UNLESS OTHERWISE NOTED
	RECEPTACLE, SPECIFIC PURPOSE - VERIFY REQMT
	AIR TERMINAL FOR LIGHTNING PROTECTION SYSTEM
	GROUND ROD WITH INSPECTION WELL
	SECTION OF CONCRETE CONDUIT BANK
	THERMOSTAT
	CONTROL STATION
	AC COMBINATION FULL VOLTAGE NON-REVERSING STARTER WITH MAGNETIC BREAKER
	TRANSFORMER (SEE SINGLE LINE DIAGRAM)
	TRANSFORMER-TYPE AND SIZE AS NOTED ON THE DRAWINGS AND IN SPECIFICATIONS
	FUSE
	MICROPROCESSOR BASED METERING DEVICE (SEE SPECIFICATIONS)
	CIRCUIT BREAKER (C INDICATES FRAME SIZE AND D INDICATES TRIP SIZE)
	EQUIPMENT/DEVICE FURNISHED AND INSTALLED UNDER SEPARATE CONTRACT. CONDUIT AND WIRE, INCLUDING TERMINATIONS, BY ELECTRICAL CONTRACTOR.
	MOTOR - INSERT DENOTES HORSE POWER
	480V DISCONNECT SWITCH, 3 POLE, 3 FUSE(a INDICATES SWITCH RATING AND b INDICATES FUSE RATING, IN AMPS)
	LIGHT POLE
	WOOD POLE
	OVERHEAD ELECTRIC CABLE
	OVERHEAD TELEPHONE CABLE

NOTE:

1. SYMBOLS/ ABBREVIATIONS LIST APPLIES TO ALL CONTRACTS
2. THE REMOVAL SYMBOL APPLIES TO ALL ITEMS TO BE REMOVED INCLUDING CIVIL, MECHANICAL, PLUMBING, HEATING, VENTILATING, ELECTRICAL ETC.

NO.	DATE	REVISION	INT.



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PROJECT ENGINEER: SL	DRAWN BY: JEZ
DESIGNED BY: SL	CHECKED BY: WDM

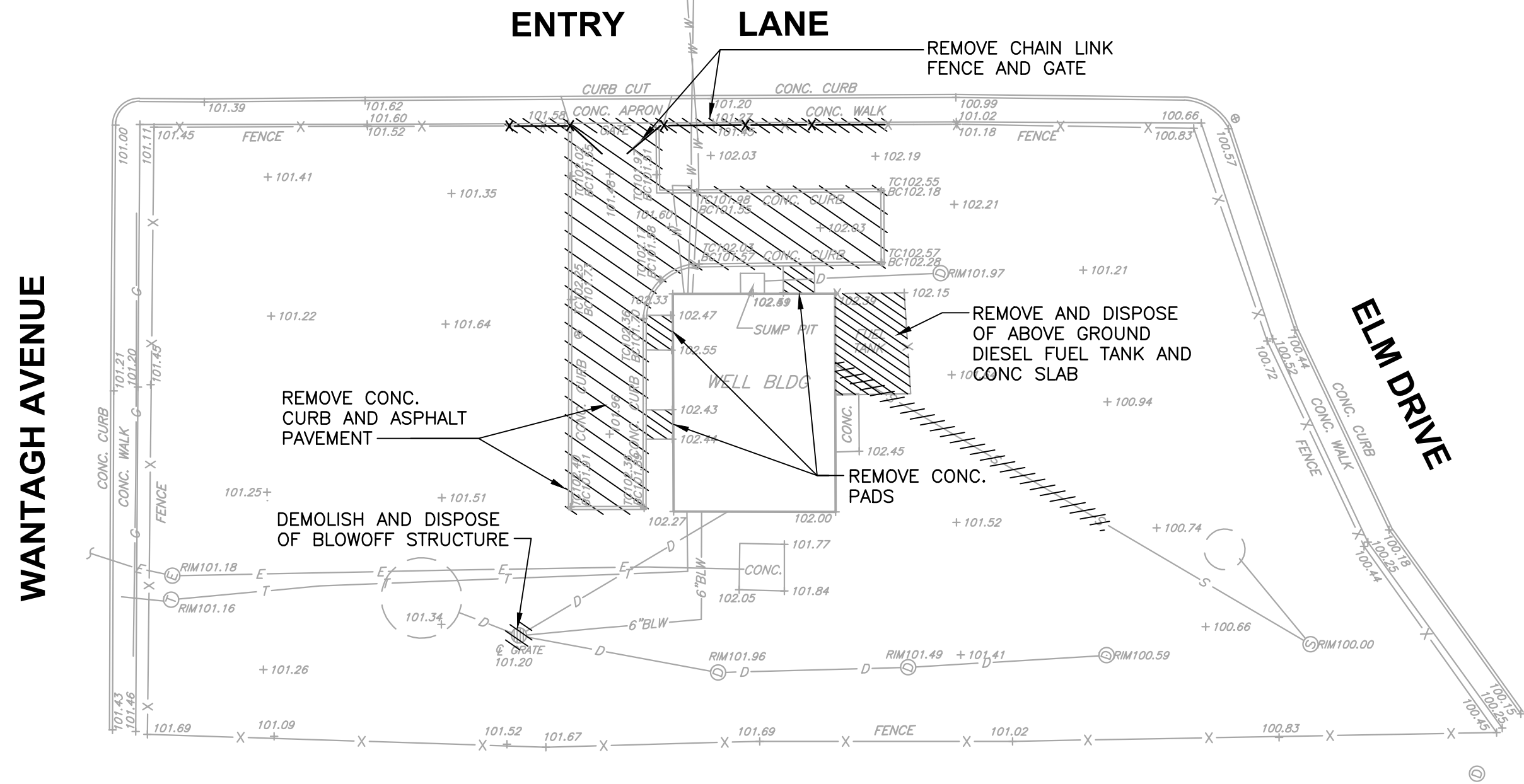
db D&B ENGINEERS
AND ARCHITECTS, P.C.
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

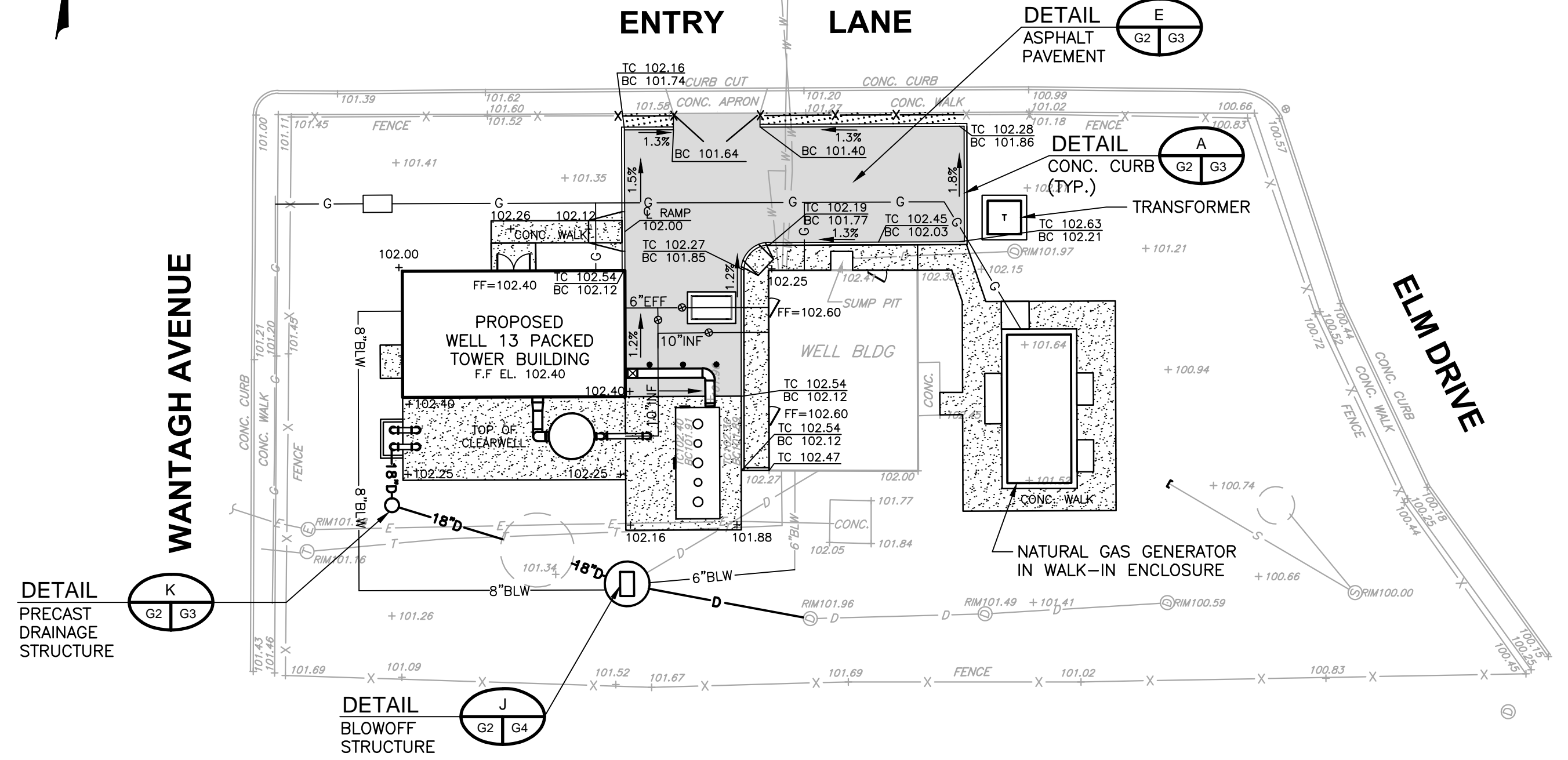
SYMBOLS AND ABBREVIATIONS

GENERAL

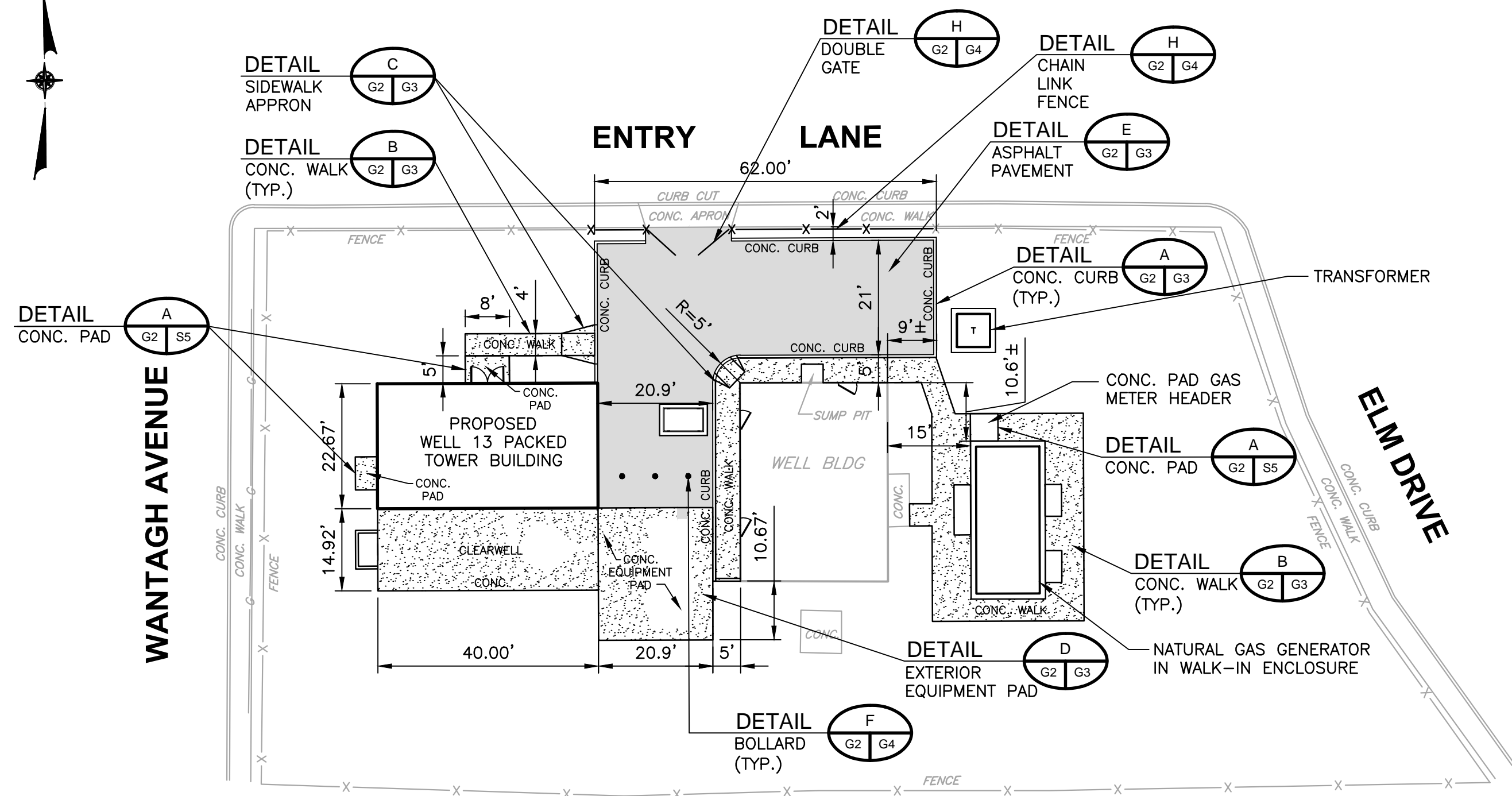
PROJECT NO. 3402	DRAWING NO.
DATE: NOVEMBER 2014	G1
SCALE: N.T.S.	



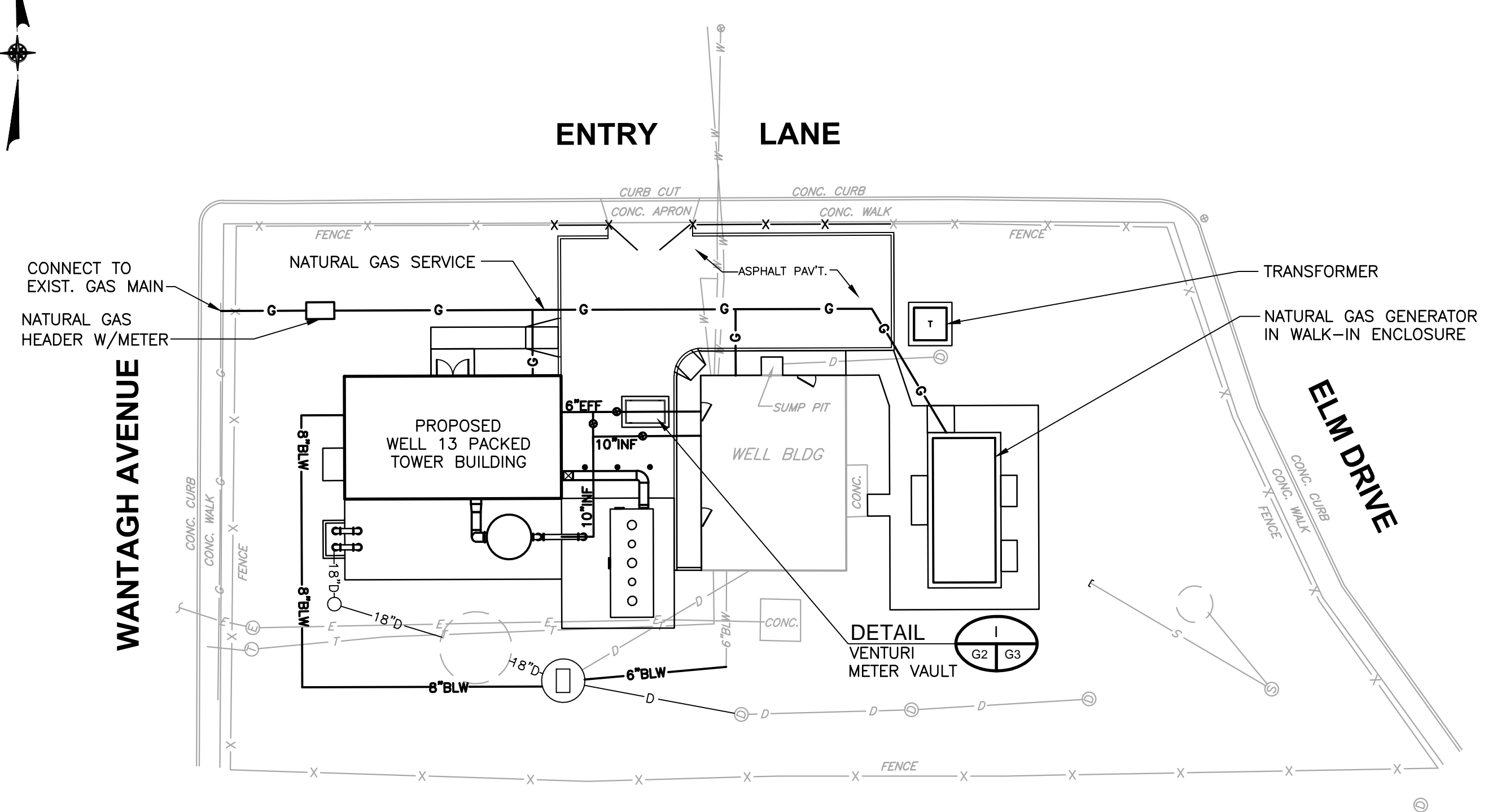
EXISTING AND DEMOLITION SITE PLAN
SCALE: 1"=20'



PROPOSED GRADING AND DRAINAGE PLAN
SCALE: 1"=20'



PROPOSED SITE LAYOUT PLAN
SCALE: 1"=20'



PROPOSED SITE PIPING PLAN
SCALE: 1"=20'

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SL		JEZ	
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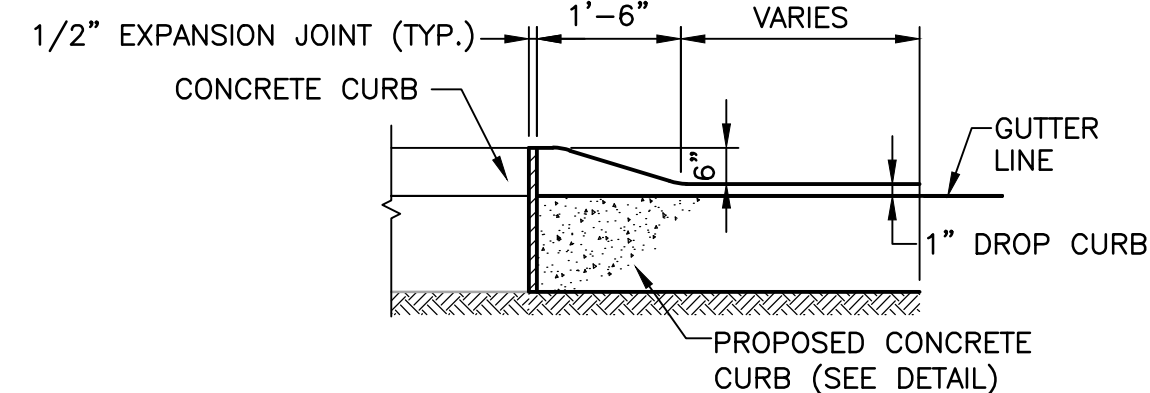
TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

EXISTING/DEMOLITION & PROPOSED SITE PLANS	
GENERAL	

PROJECT NO. 3402	DRAWING NO. G2
DATE: NOVEMBER 2014	
SCALE: 1"=20'	



1. NEW CURB SHALL HAVE A SMOOTH TRANSITION WITH EXISTING CURB
2. CURB REVEAL SHALL BE 6" EXCEPT AT DROP-CURB. OR WHERE INDICATED OTHERWISE
3. ½" PREMOULDED EXPANSION JOINT FILLER SHALL BE INSTALLED AT 20' O.C. AND AT JOINTS WITH EXISTING CONCRETE CURB.



CONC. SIDEWALK

EXPANSION JOINT AS REQUIRED

4'-0"

WARPED SURFACE OF APRON

GUTTER LINE

6x12-3/3 WWF

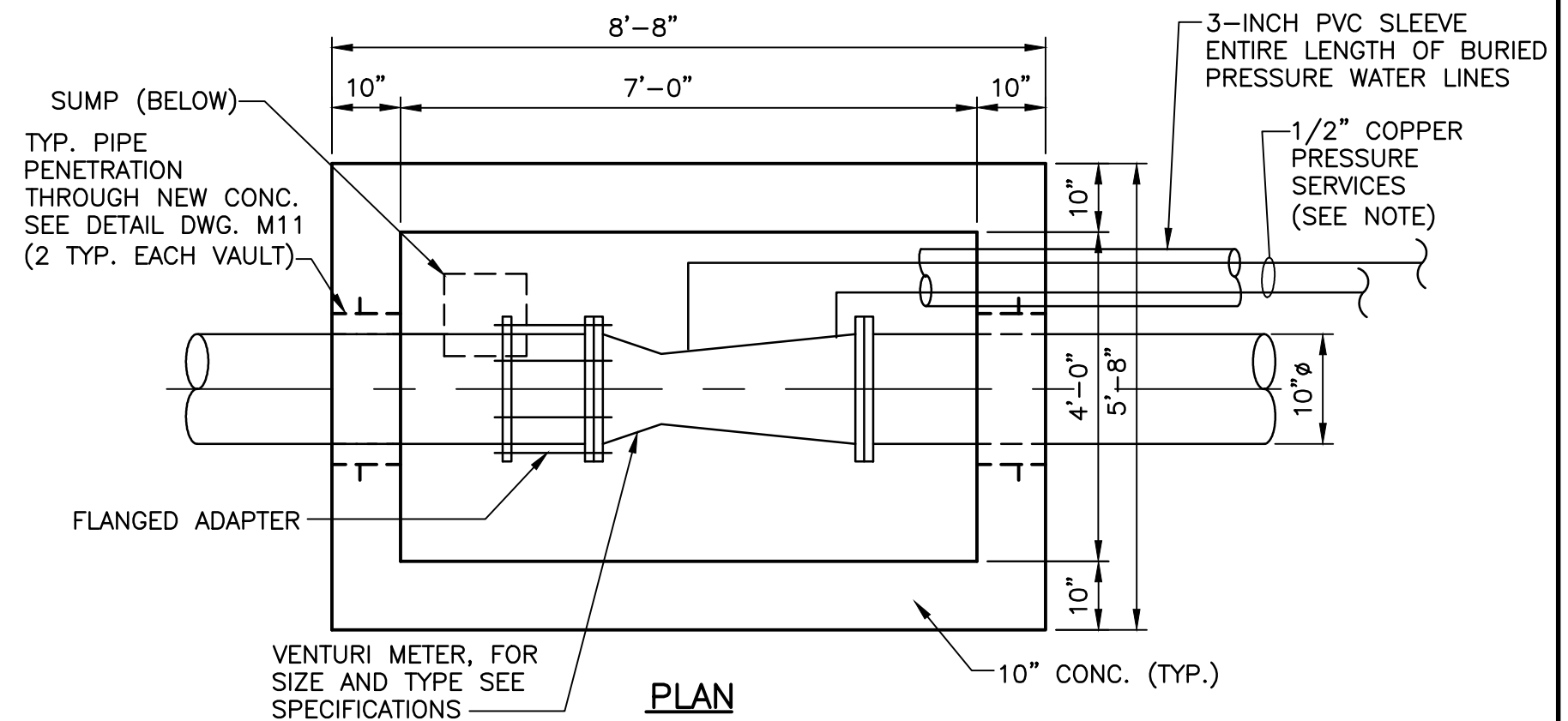
6"

WELL COMPACTED, APPROVED SUBGRADE MATERIAL

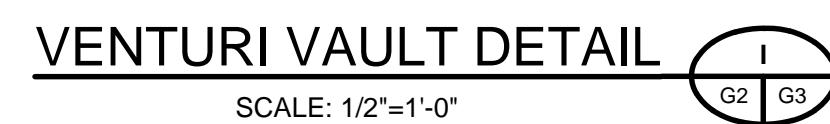
SECTION 2
SIDEWALK APRON DETAIL

N.T.S

C
G2 G3



NOTE:
CONTRACTOR SHALL FURNISH AND INSTALL 1/2" COPPER PIPE FOR LOW PRESSURE AND HIGH PRESSURE SIGNAL TO FLOW TRANSMITTER AS NECESSARY TO PROVIDE FOR A COMPLETE OPERATIONAL SYSTEM. INSTALL COPPER SERVICES IN 3-INCH PVC SLEEVE FOR ENTIRE BURIED LENGTH. PROVIDE 4'-0" COVER OVER PRESSURE SENSING SERVICES. SLOPE 1/2" COPPER PIPE MIN. 1/4" PER FT. DOWN TOWARDS VENTURI METER TO PERMIT PURGING OF AIR.



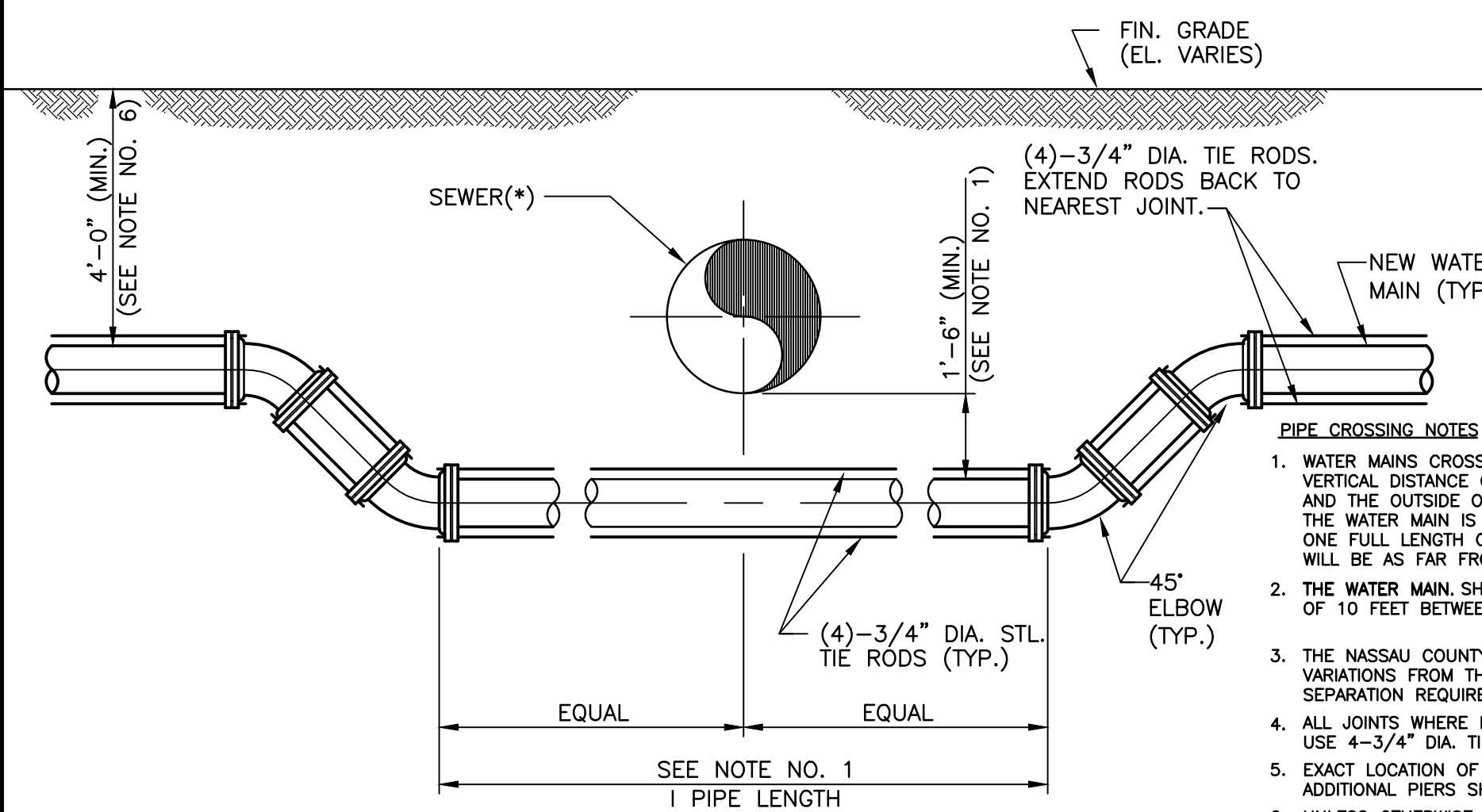
PROJECT ENGINEER: SL	DRAWN BY: JEZ
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SITE DETAILS I

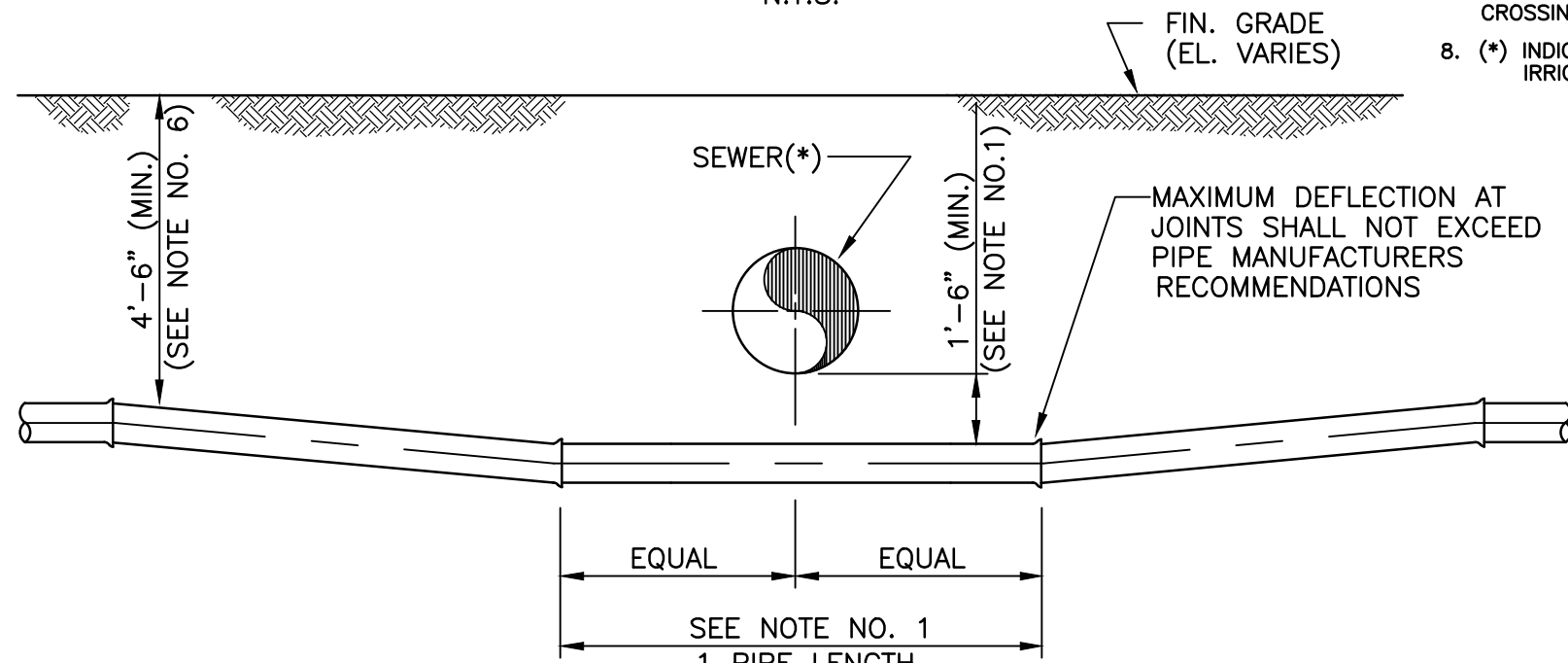
GENERAL

PROJECT NO. 3402	DRAWING NO.
DATE: NOVEMBER 2014	G3
SCALE: 1"=20'	



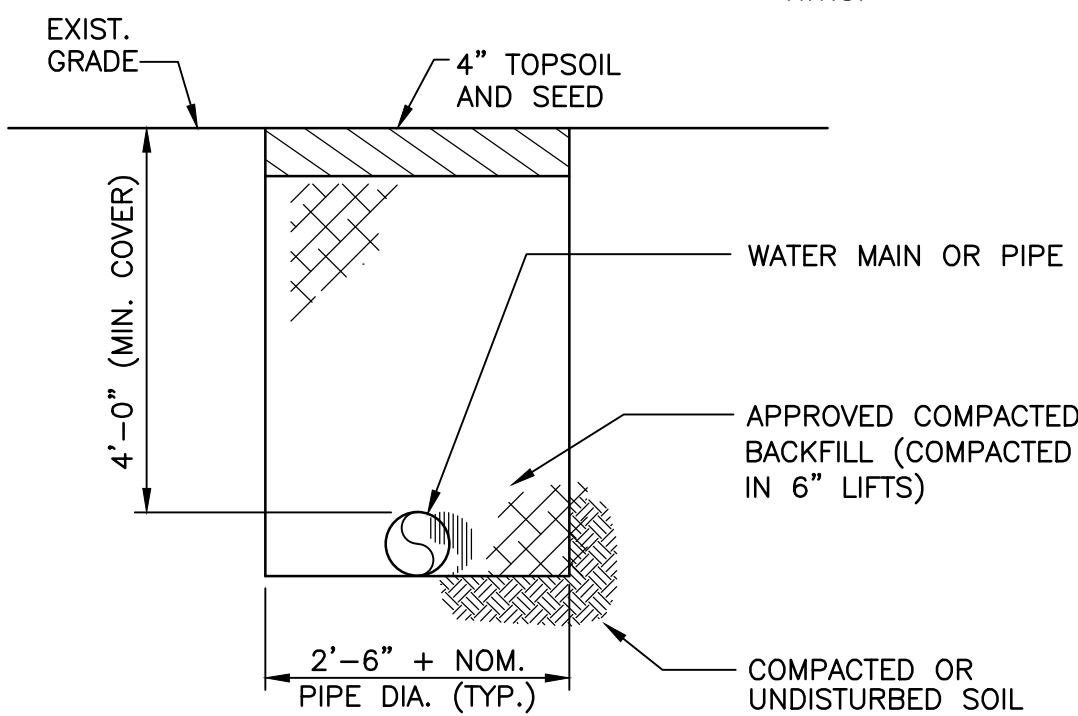
SPECIAL PIPE CROSSING DETAIL

N.T.S.



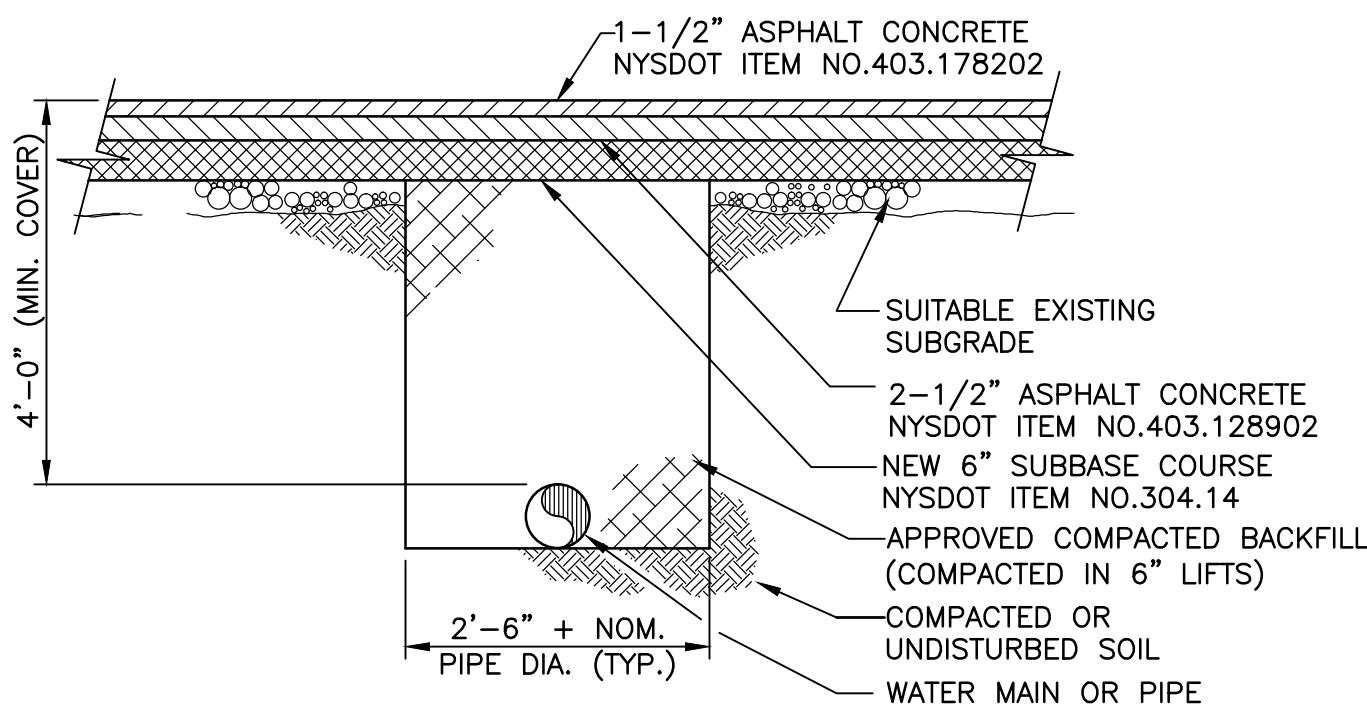
TYPICAL PIPE CROSSING DETAIL

N.T.S.



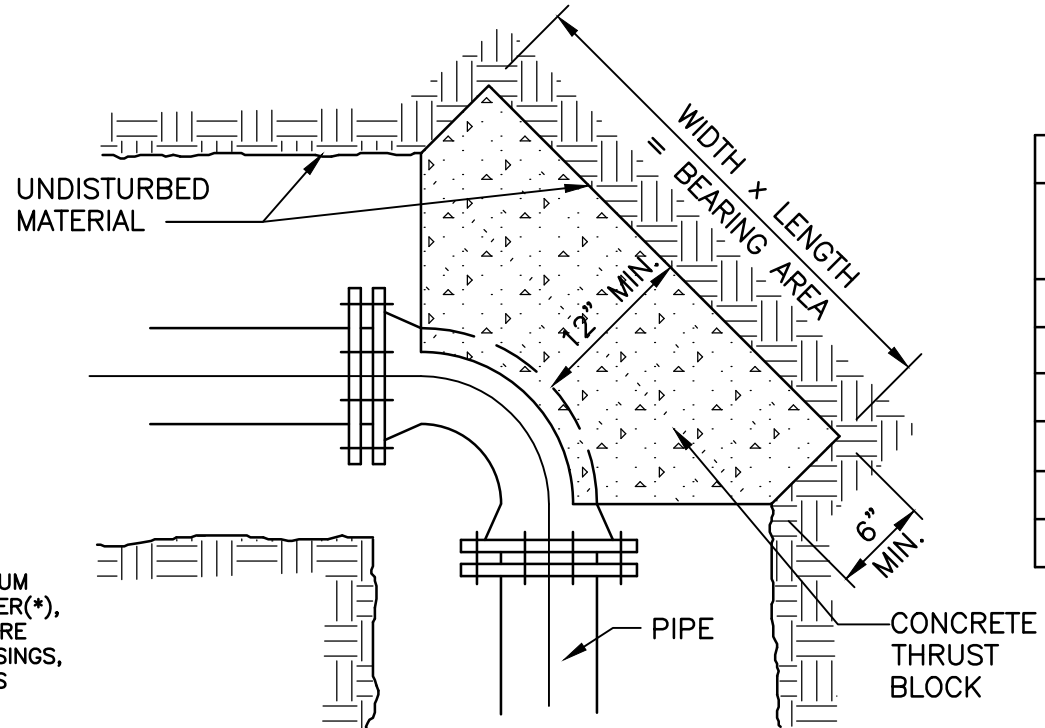
TYPICAL PIPE TRENCH IN UNPAVED AREA

N.T.S.



TYPICAL PIPE TRENCH IN PAVED AREA

N.T.S.



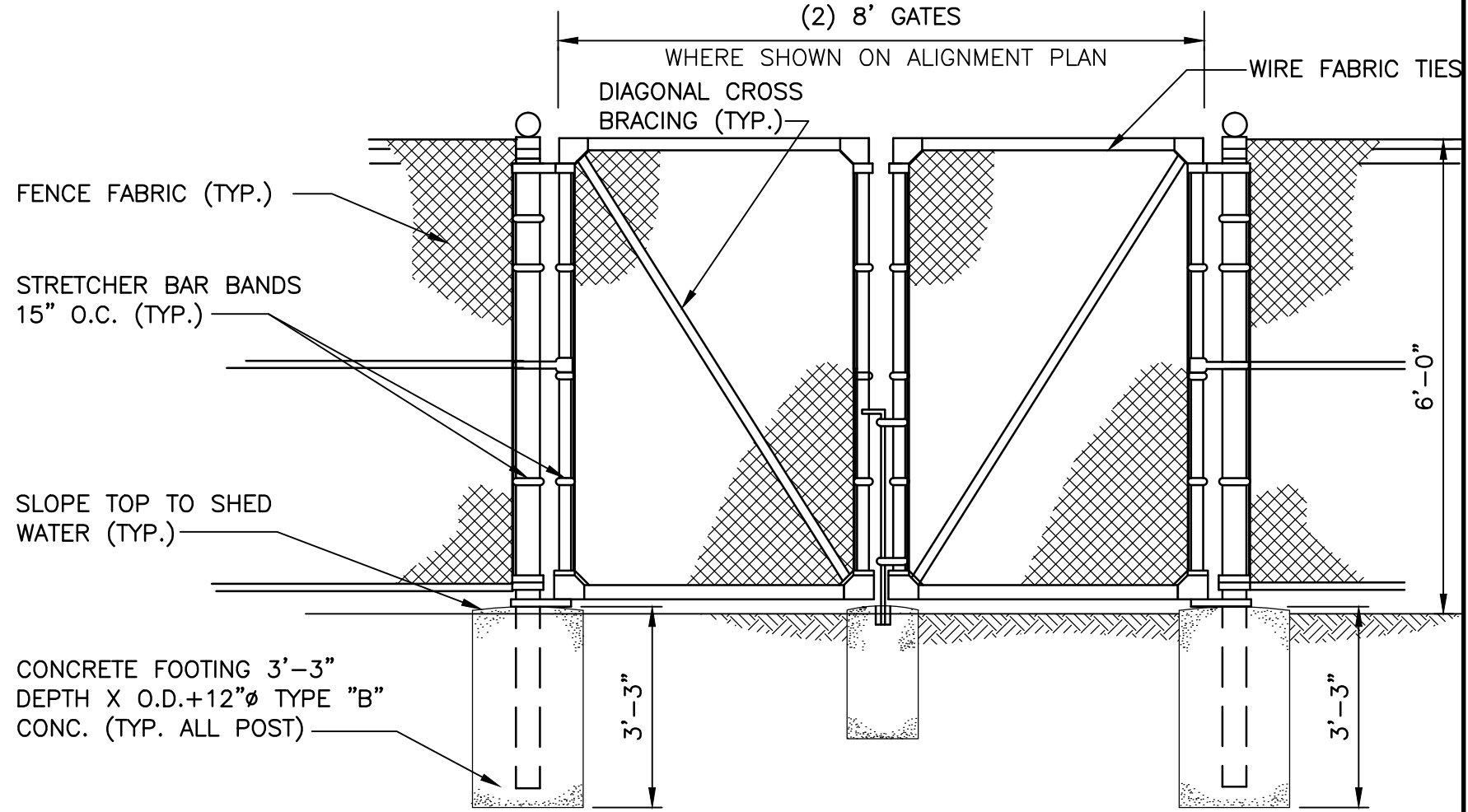
CONCRETE THRUST BLOCK SCHEDULE

N.T.S.

NOTE:

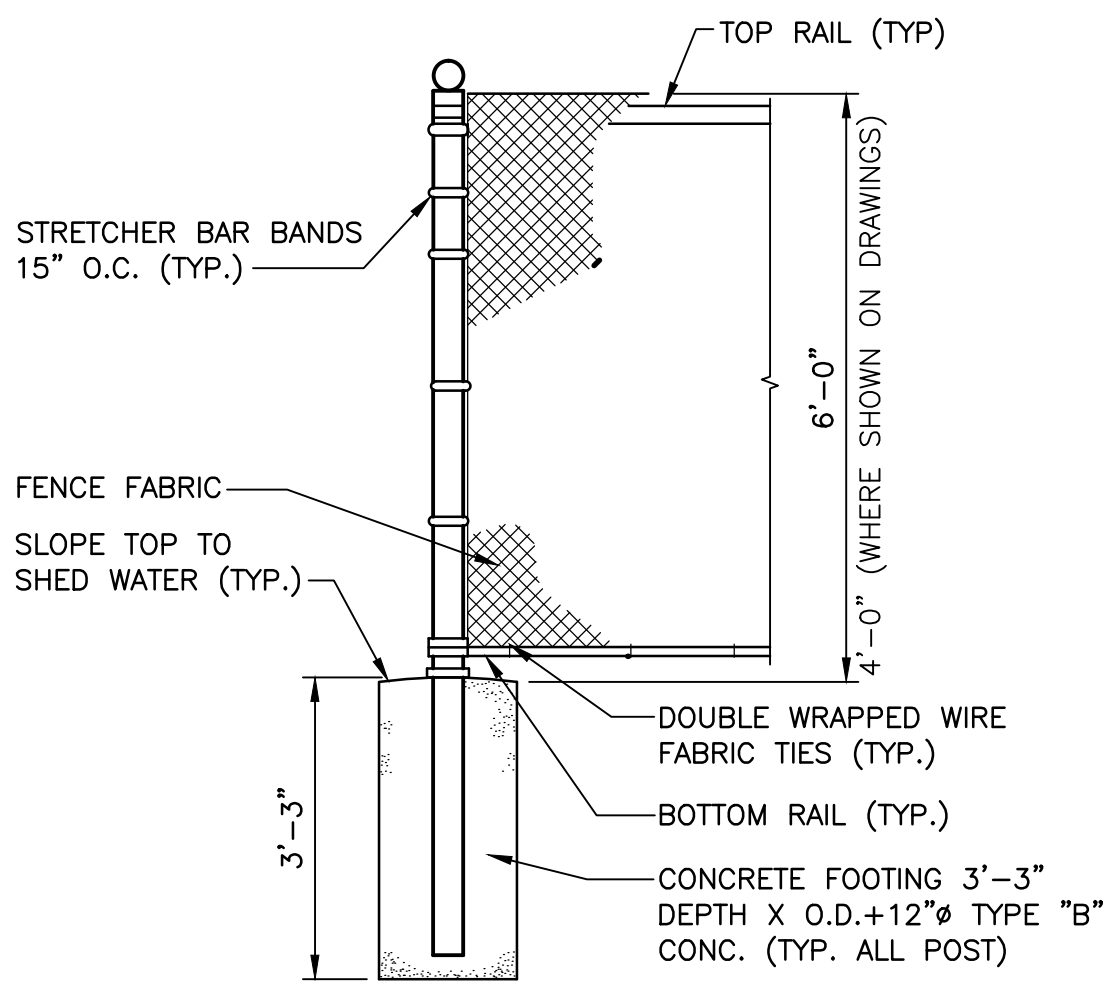
THRUST BLOCKS SHALL BE PROVIDED PER SPECIFICATIONS AND SHALL OCCUR AT ALL CHANGES IN DIRECTION HORIZONTAL OR VERTICAL AND ALL OTHER POINTS REQUIRING RESISTANCE TO PRESSURE.

PIPE SIZE	FITTING TYPE					
	11-1/4"	22-1/2"	45"	90"	TEE	WYE
6"	1	1	2	3	2	2
8"	2	2	3	5	4	4
10"	2	2	4	7	5	5
12"	3	3	6	10	7	7
16"	6	6	11	19	14	-
18"	6	6	12	23	16	16



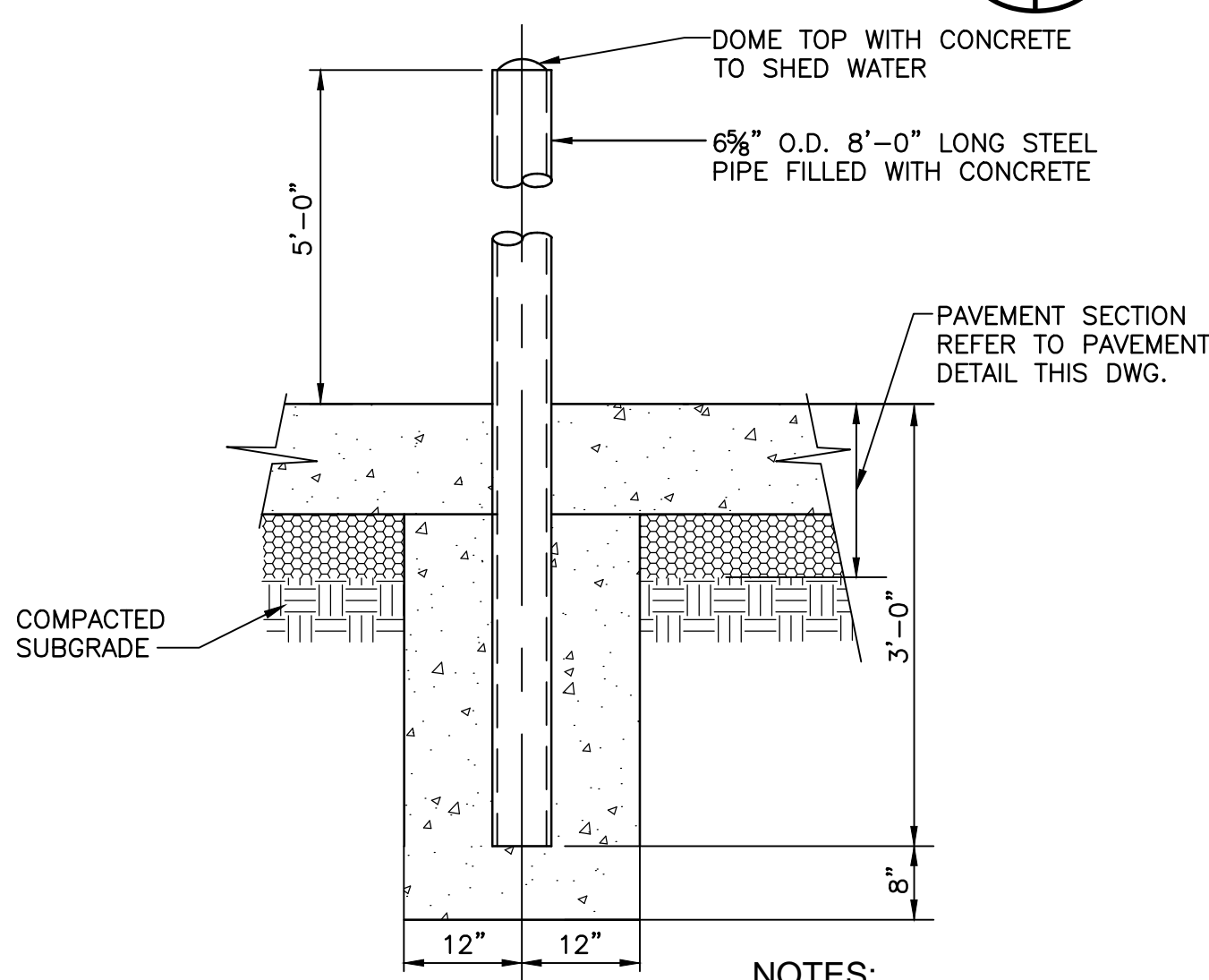
DOUBLE GATE DETAIL

N.T.S.



CHAIN LINK FENCE DETAIL

N.T.S.

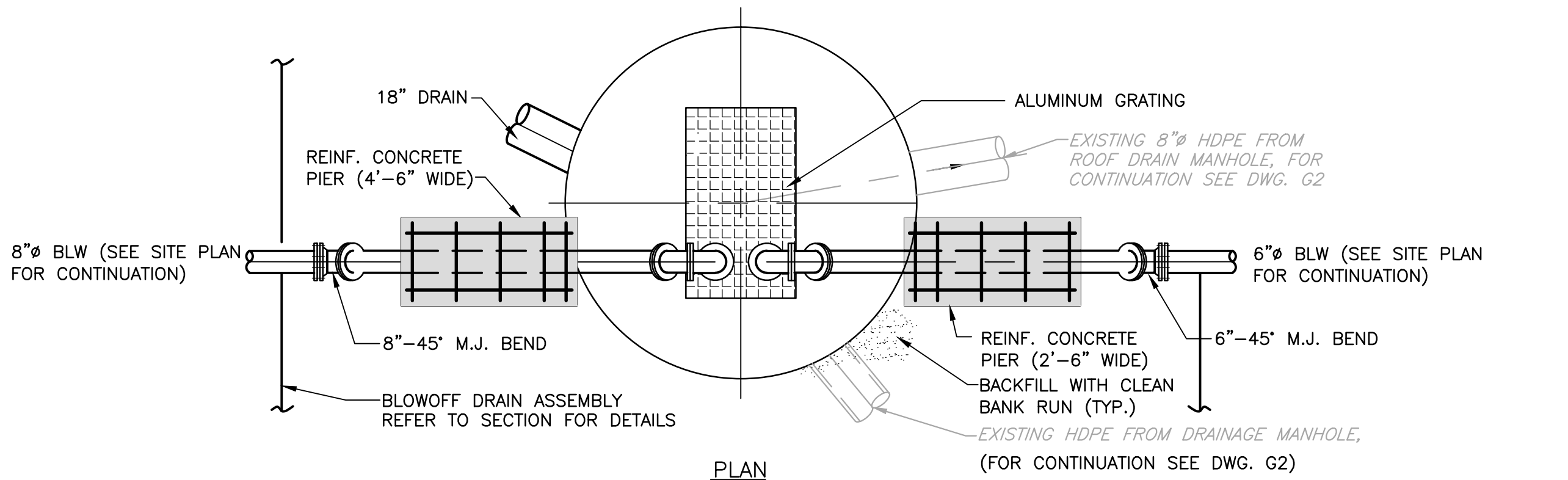


BOLLARD DETAIL

N.T.S.

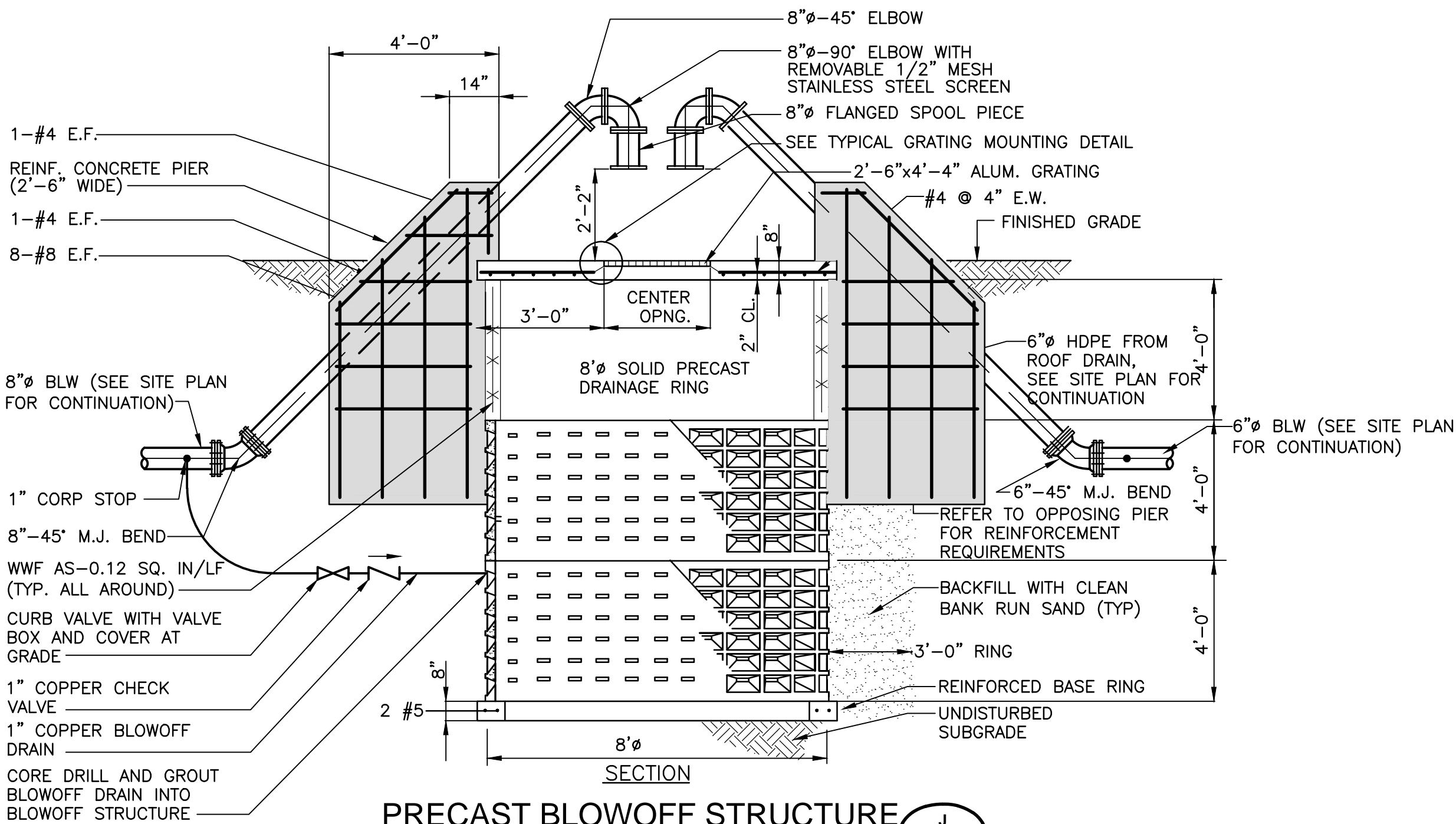
NOTES:

1. BOLLARDS SHALL BE PAINTED YELLOW IN ACCORDANCE WITH SECTION 09900.
2. REFER TO SITE PLANS FOR BOLLARD LOCATIONS



PRECAST BLOWOFF STRUCTURE

N.T.S.



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SL	WDM

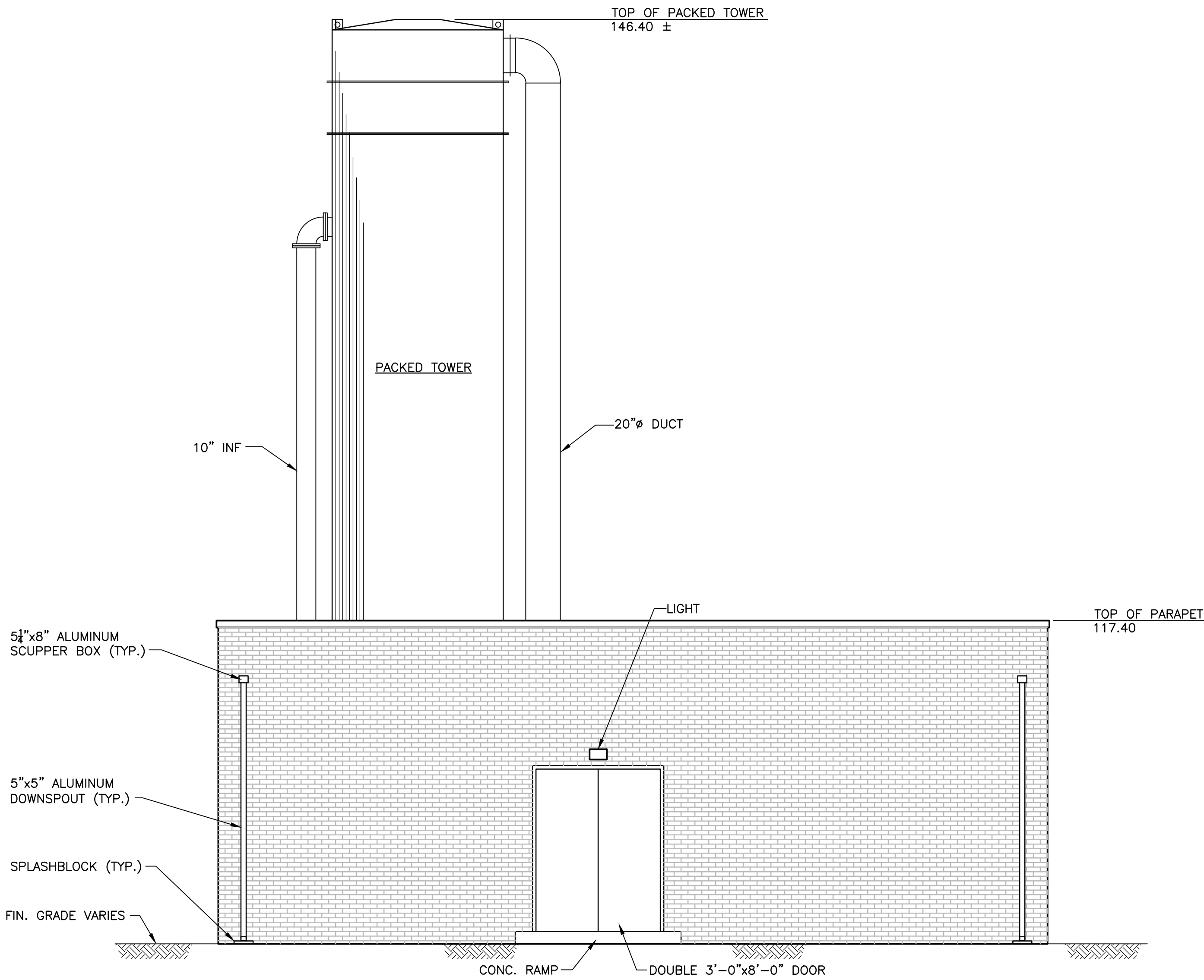
db **D&B ENGINEERS AND ARCHITECTS, P.C.**
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TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

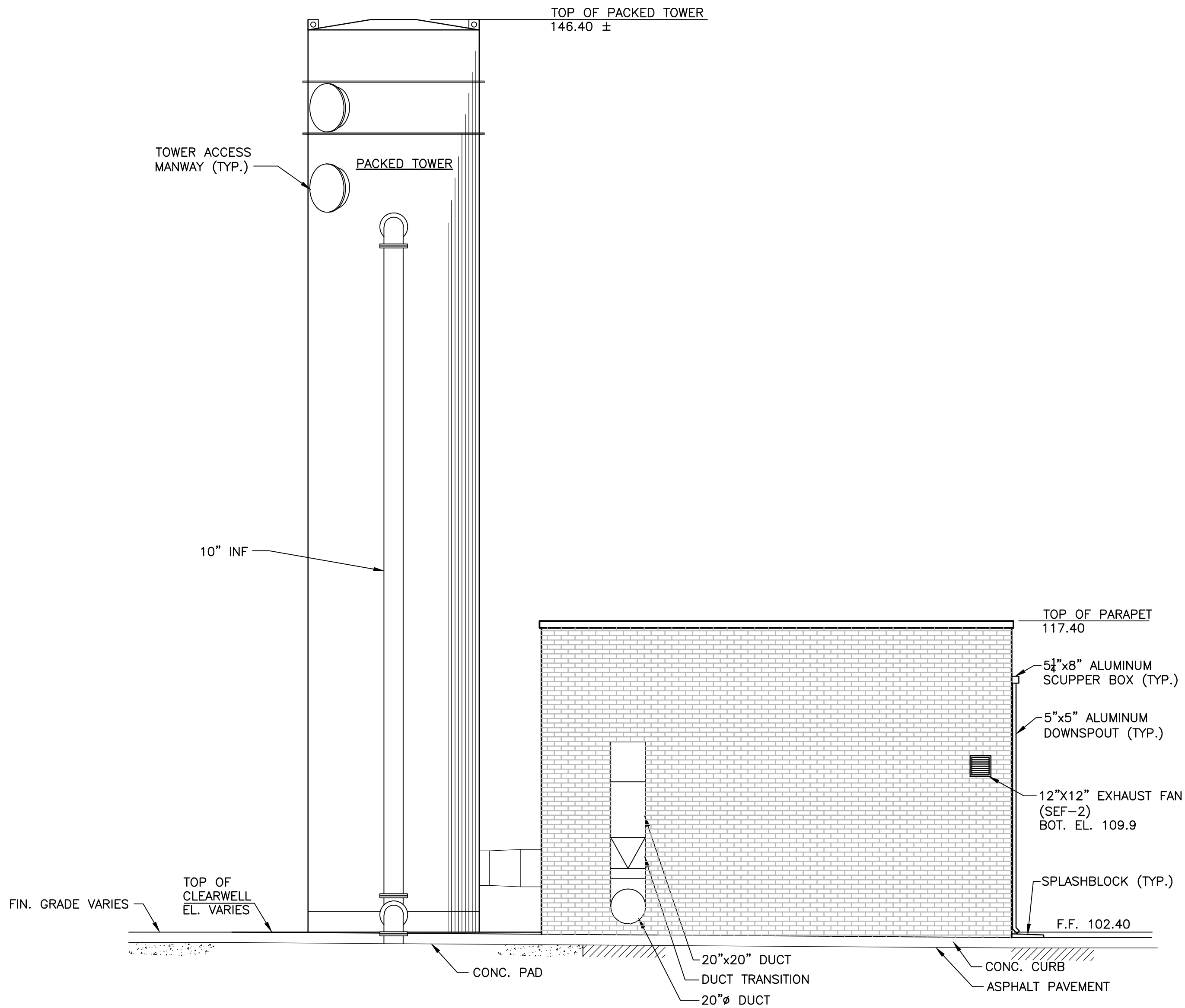
SITE DETAILS II

GENERAL

PROJECT NO.	G4
3402	
DATE:	
NOVEMBER 2014	SCALE:
1"=20'	



NORTH ELEVATION
SCALE: 1/4"=1'-0"




EAST ELEVATION
SCALE: 1/4"=1'-0"

NO.	DATE	REVISION	INT.



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SL		WDM	



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AND
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KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

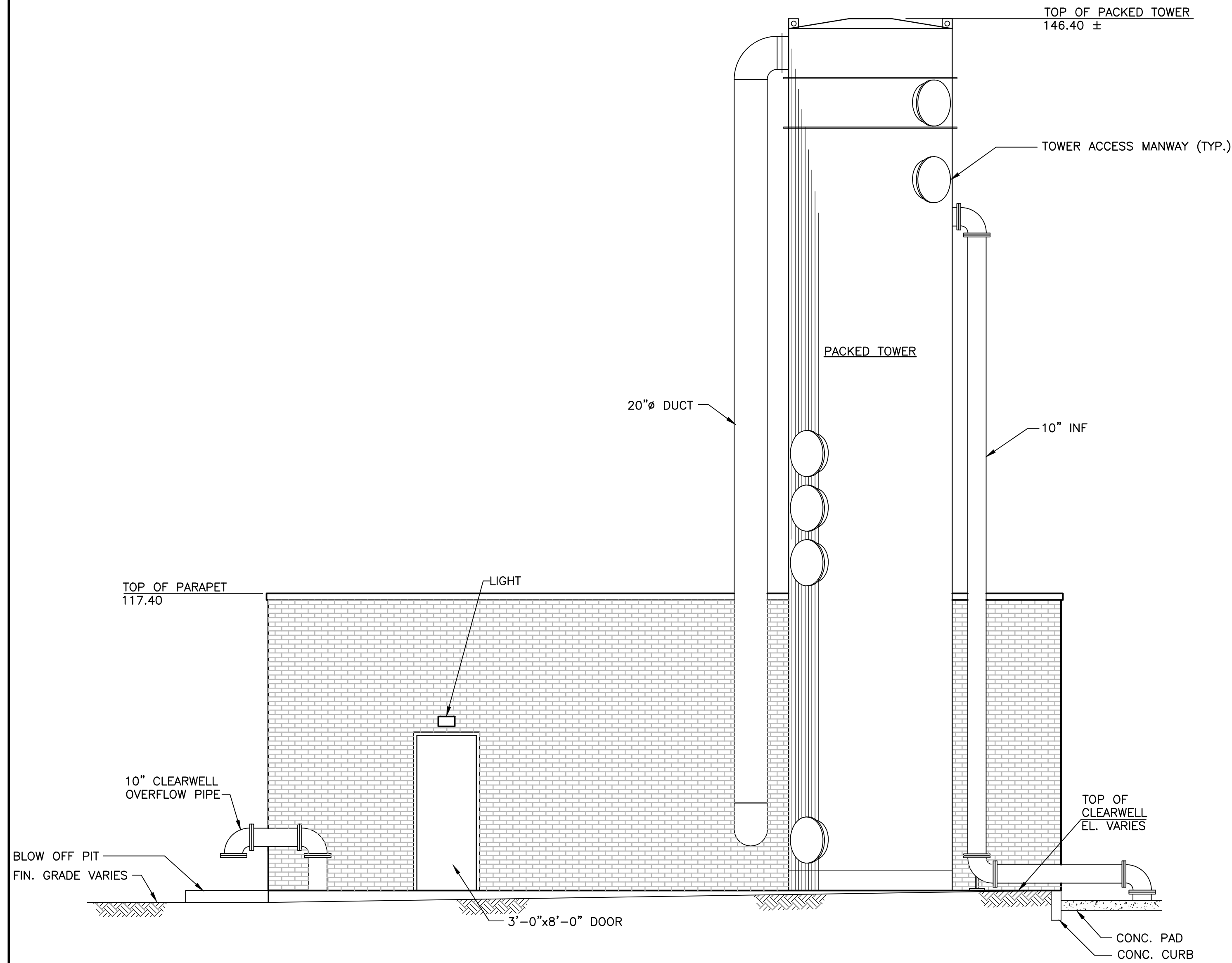
NASSAU COUNTYNEW YORK

**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**
LEVITTOWN WATER DISTRICT
**CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

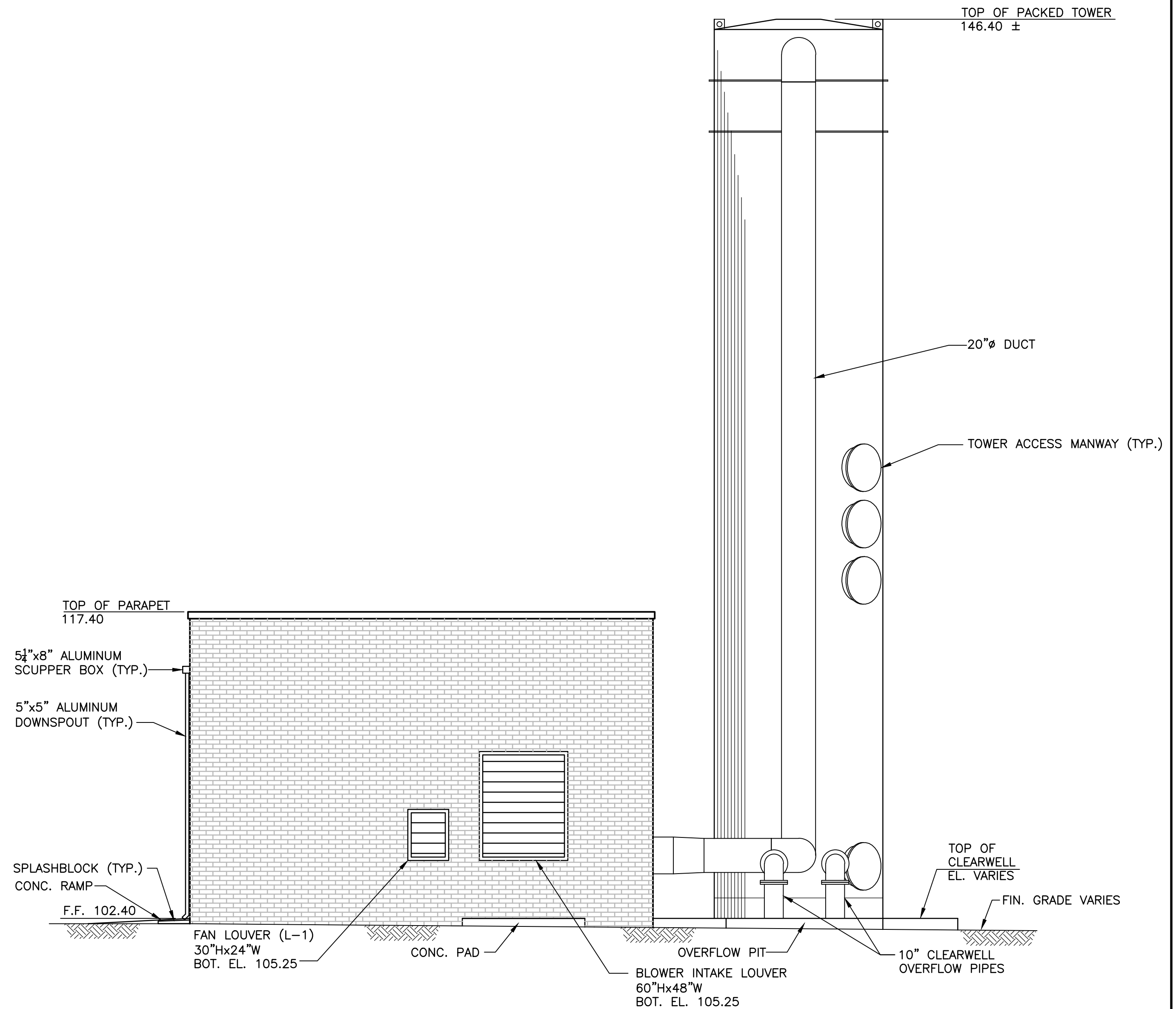
**PACKED TOWER BUILDING
NORTH AND EAST ELEVATIONS**
ARCHITECTURAL

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: 3/8"=1'-0"

DRAWING NO.
A1



SOUTH ELEVATION
SCALE: 1/4"=1'-0"



WEST ELEVATION
SCALE: 1/4"=1'-0"

NO.	DATE	REVISION	INT.



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SL		WDM	

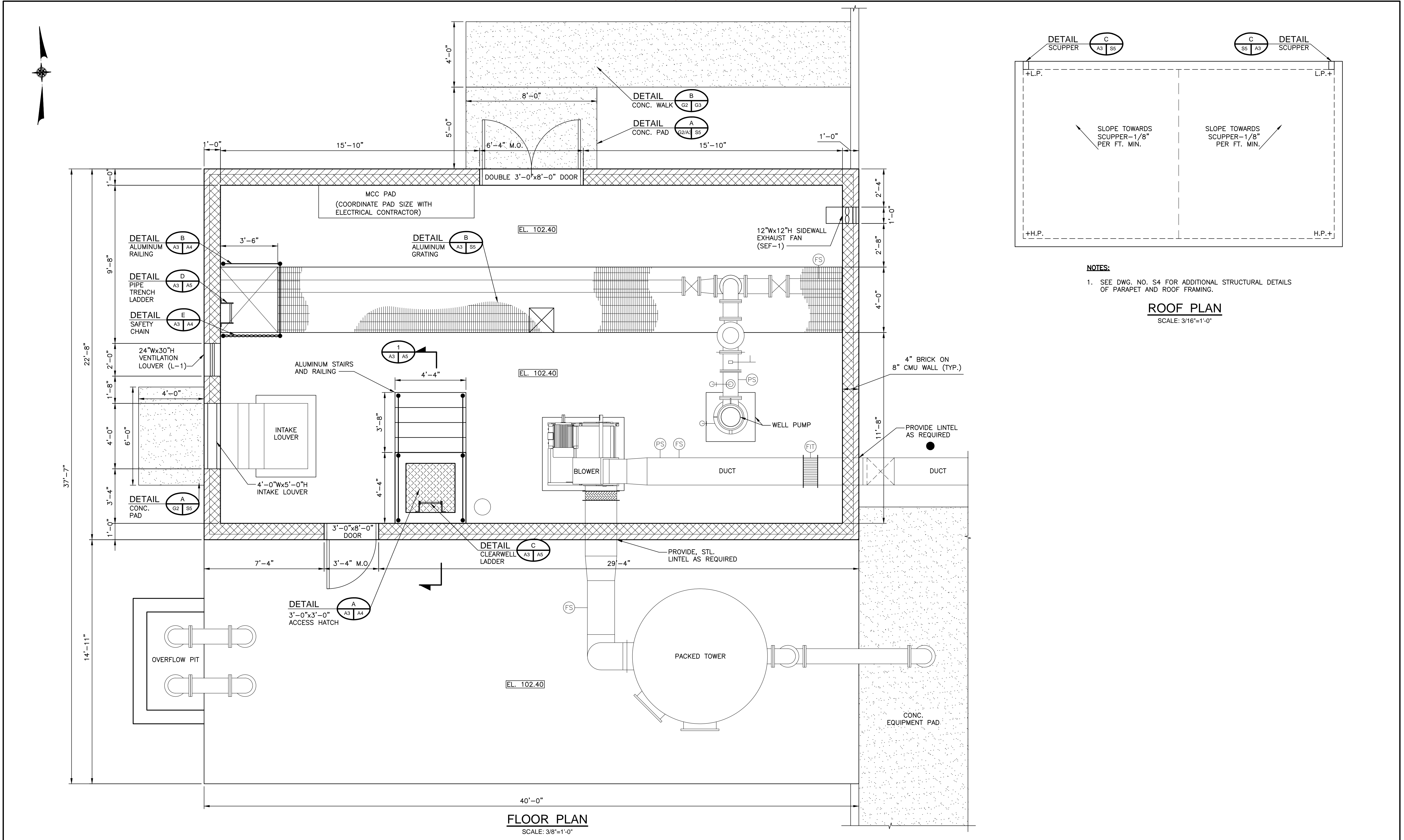
db **D&B ENGINEERS AND ARCHITECTS, P.C.**
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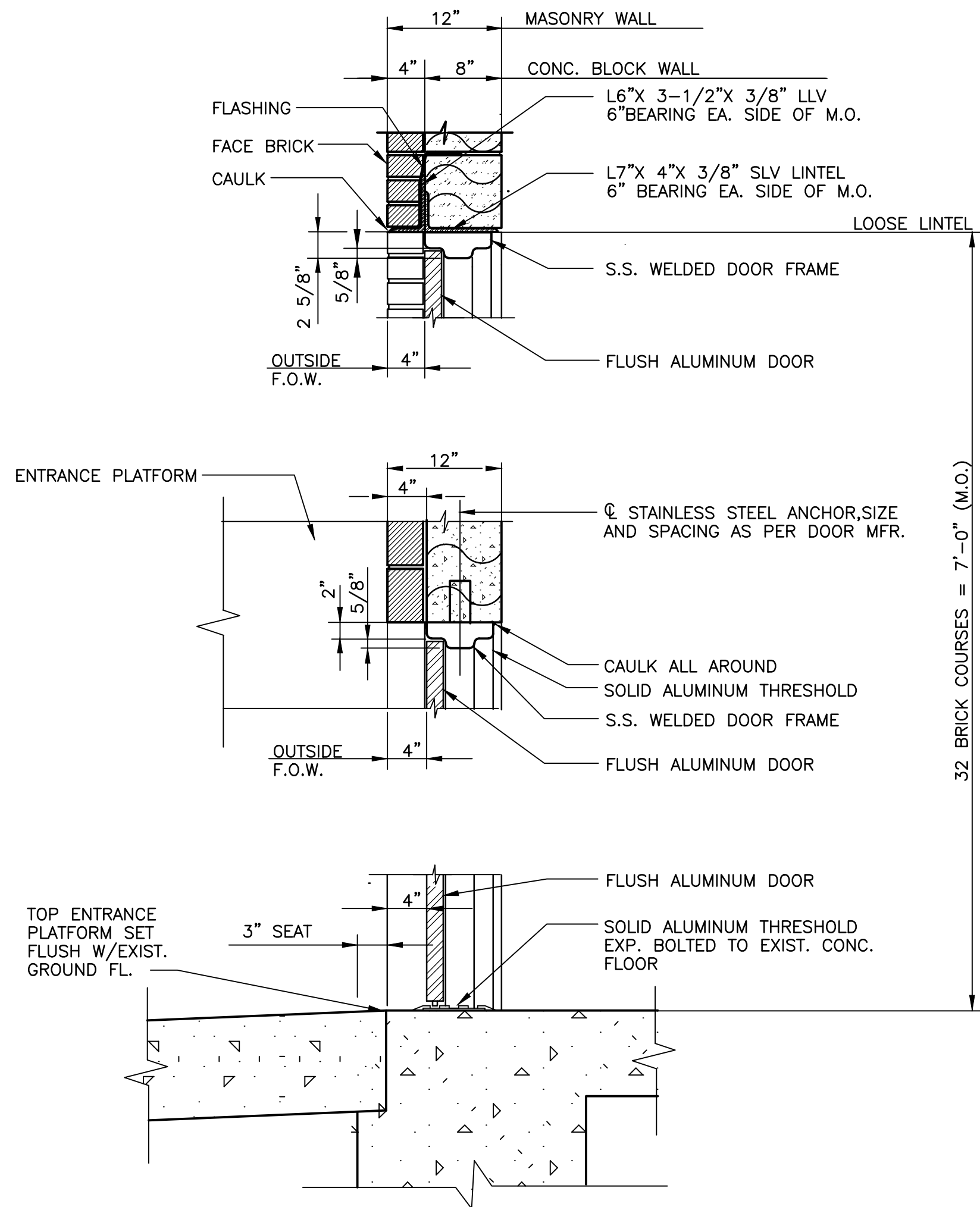
TOWN OF HEMPSTEAD	
DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

PACKED TOWER BUILDING
SOUTH AND WEST ELEVATIONS
ARCHITECTURAL

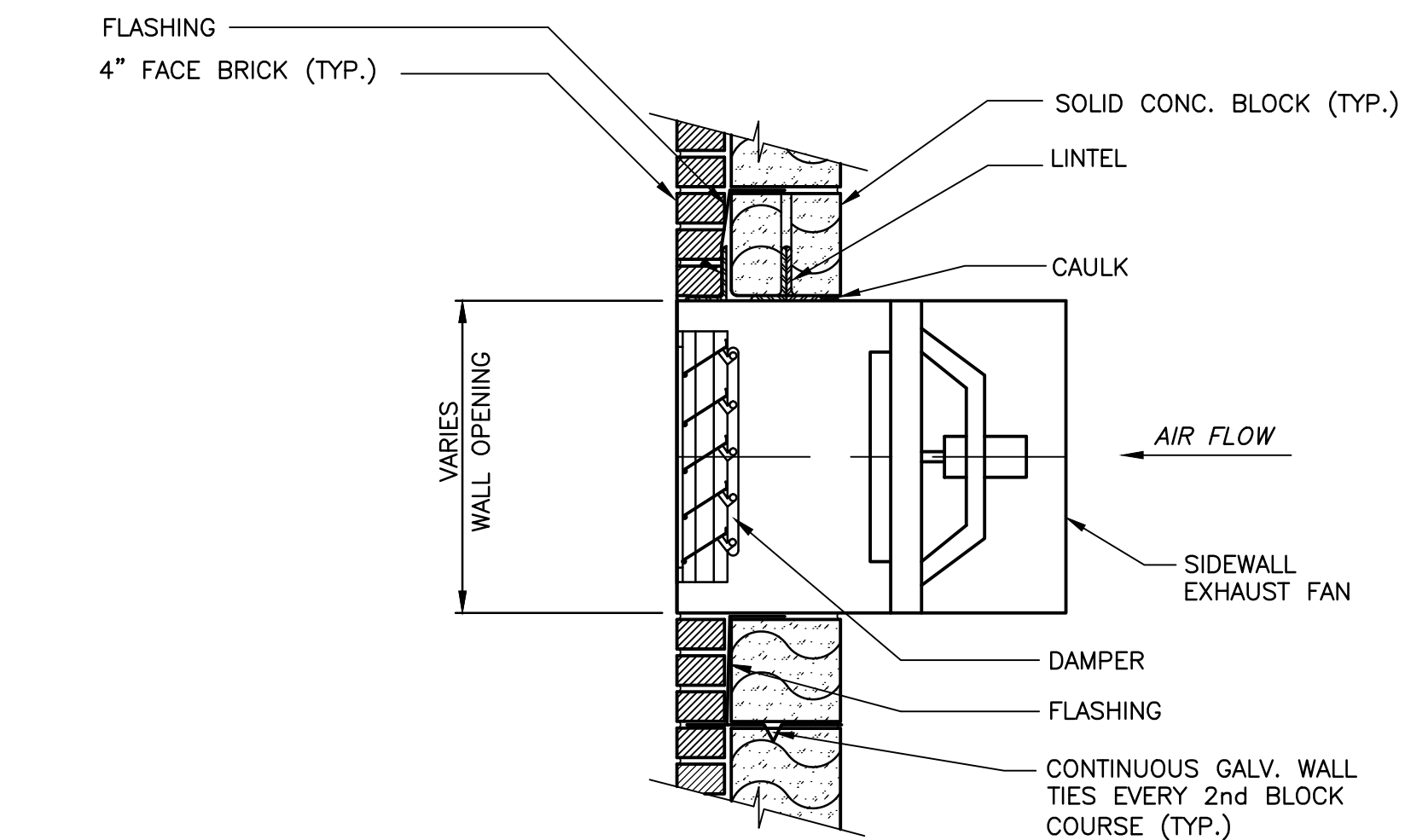
PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: 3/8"=1'-0"

DRAWING NO. A2

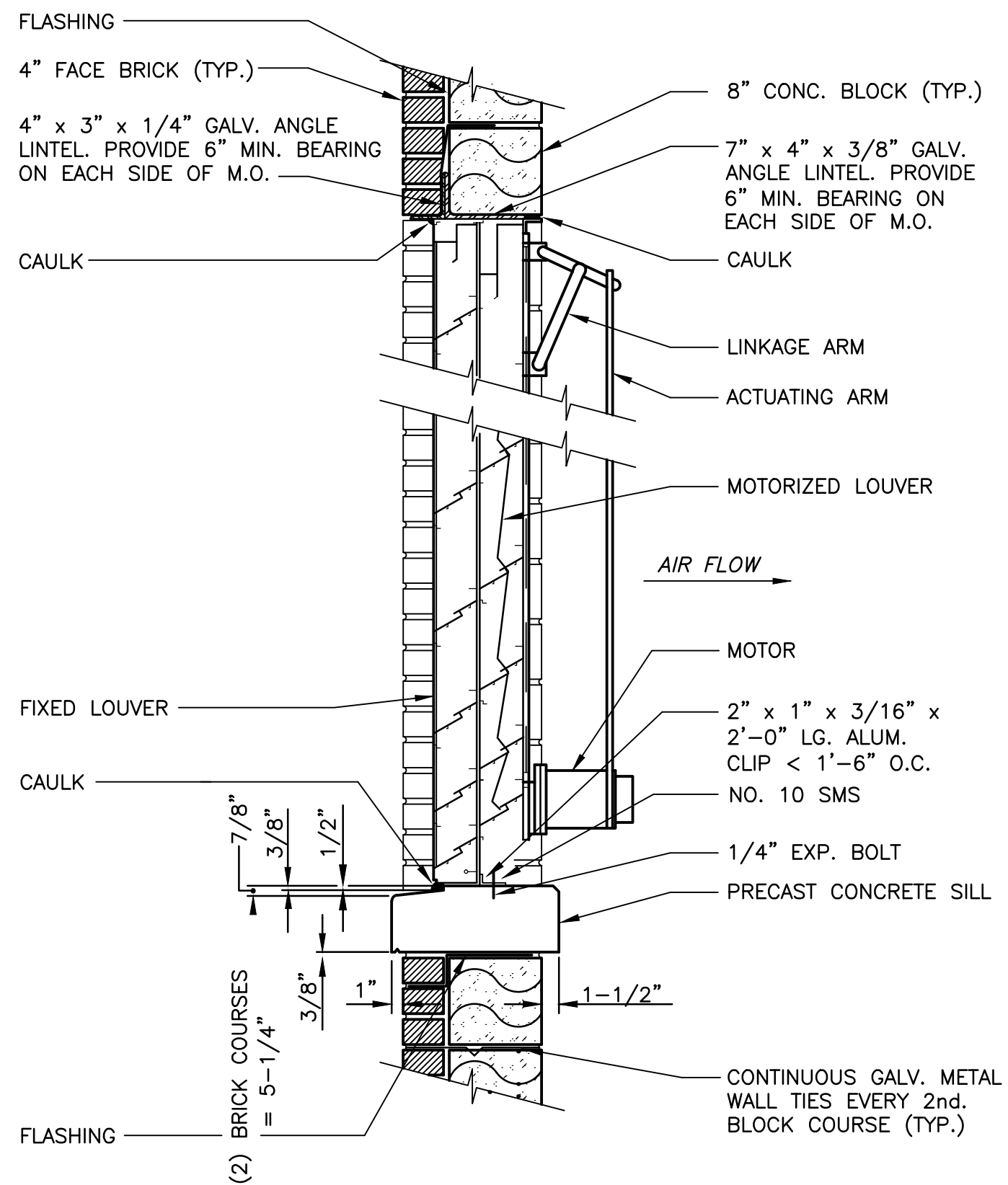




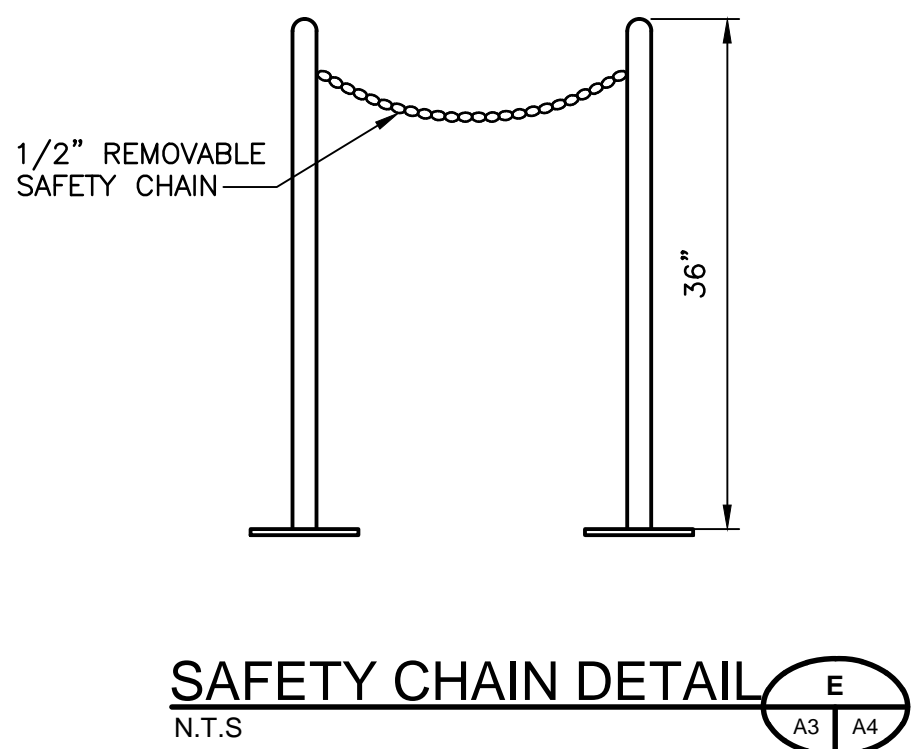
DOOR THROUGH NEW BRICK AND BLOCK WALL DETAIL
N.T.S.



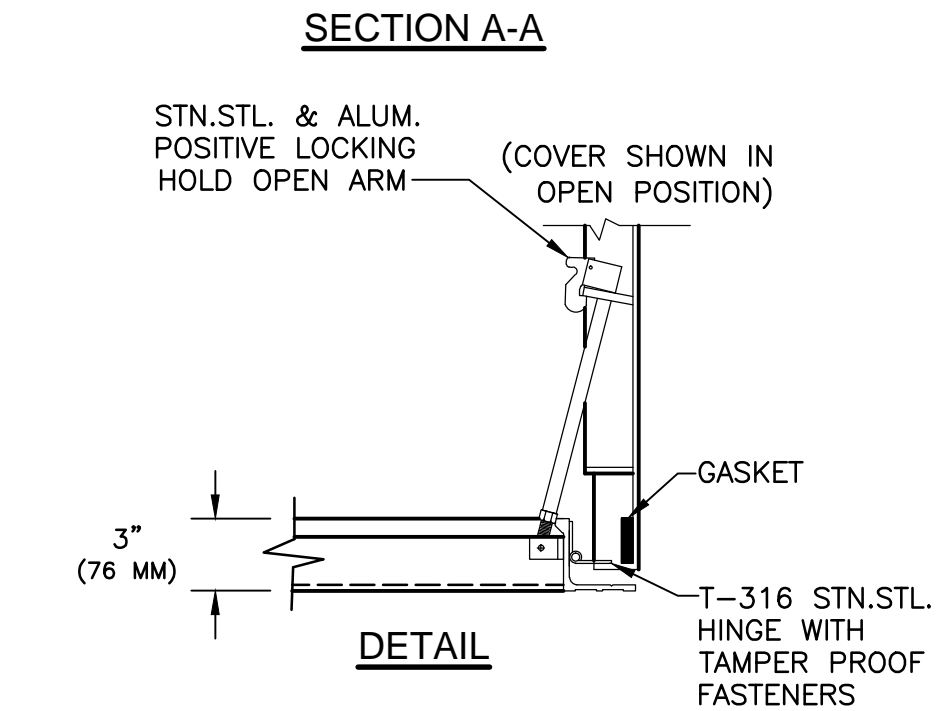
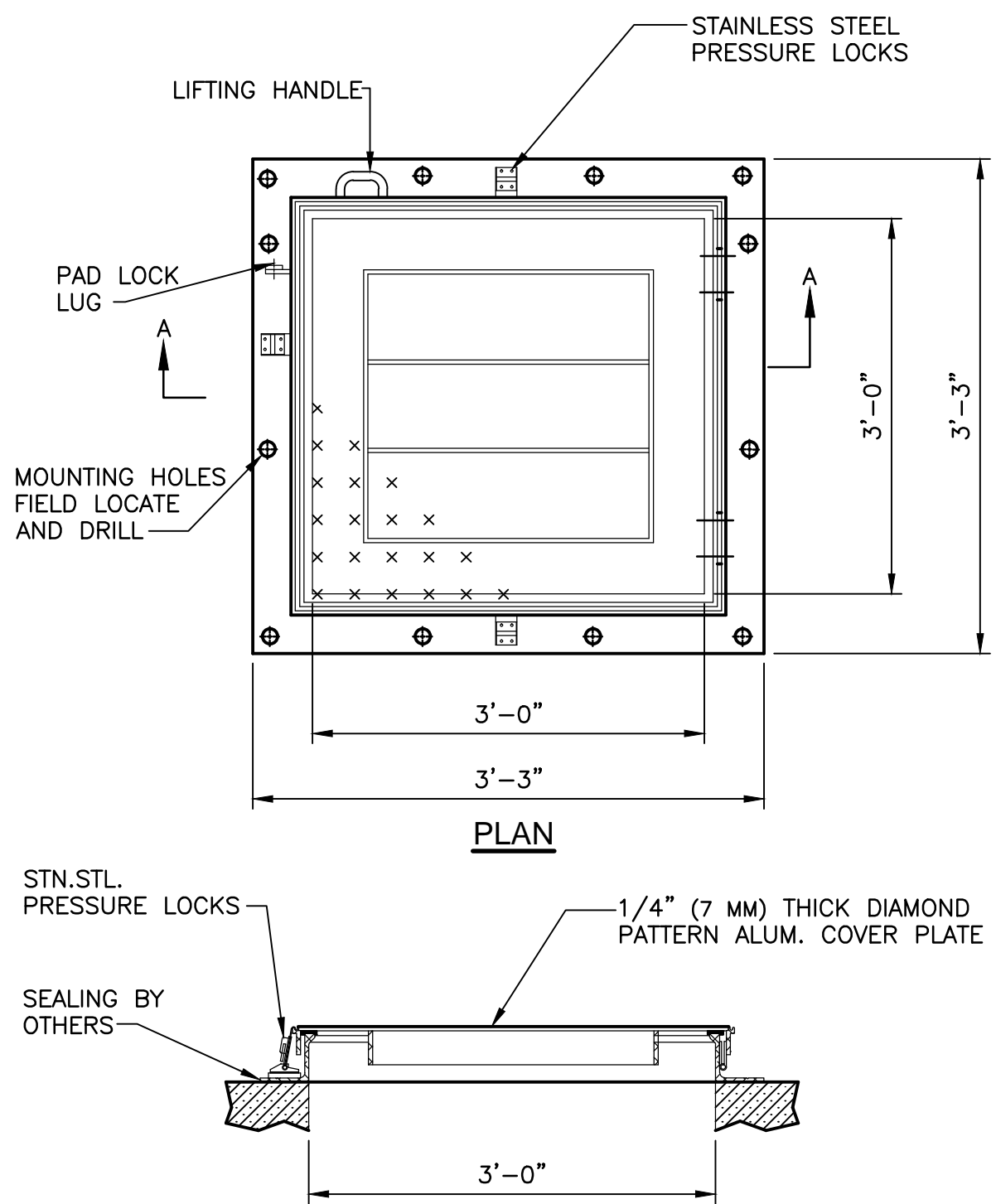
**TYPICAL SIDEWALL EXHAUST FAN DETAIL
THROUGH BRICK & BLOCK WALL**
N.T.S.



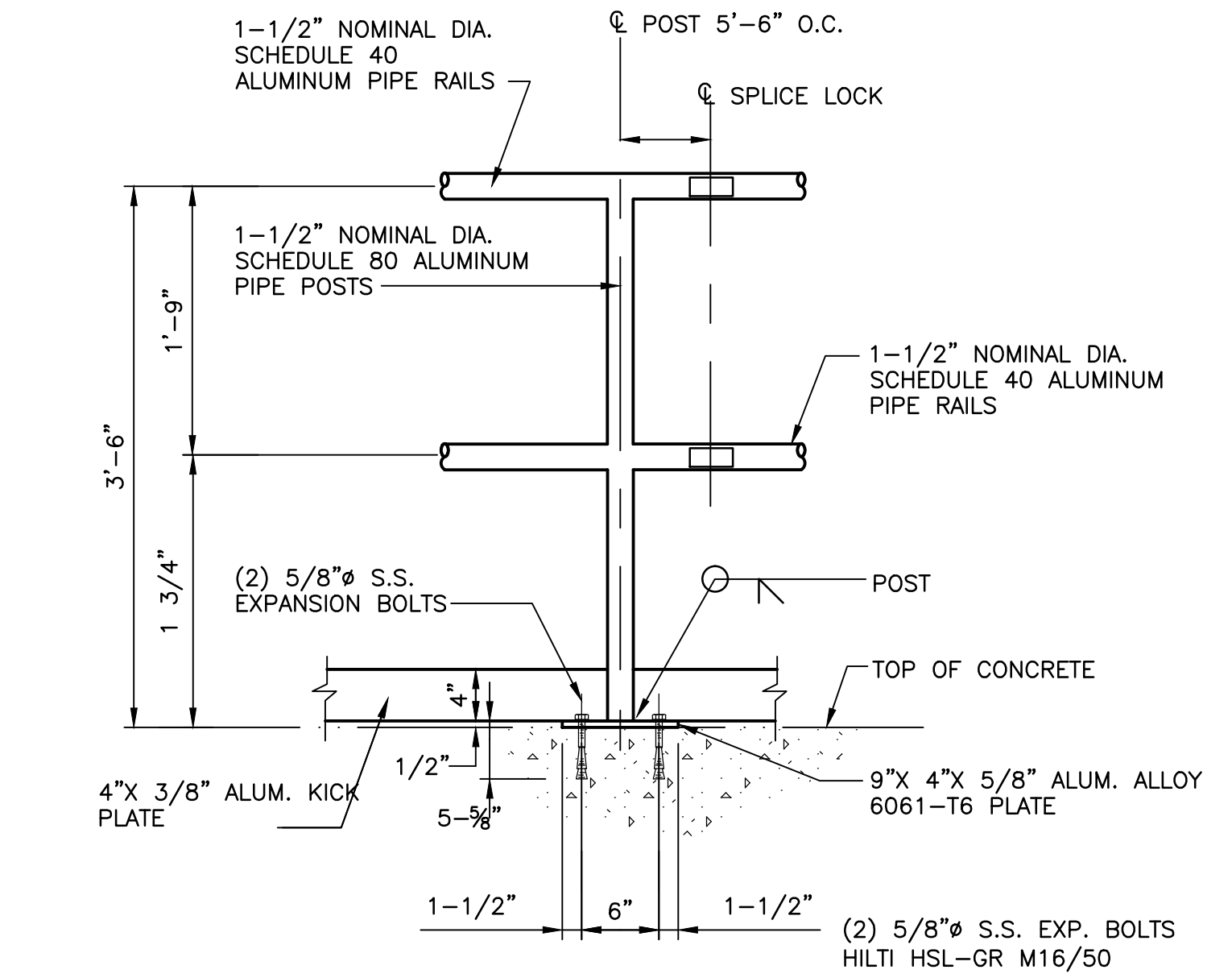
LOUVER THROUGH BRICK AND BLOCK WALL DETAIL
N.T.S.



SAFETY CHAIN DETAIL
N.T.S.



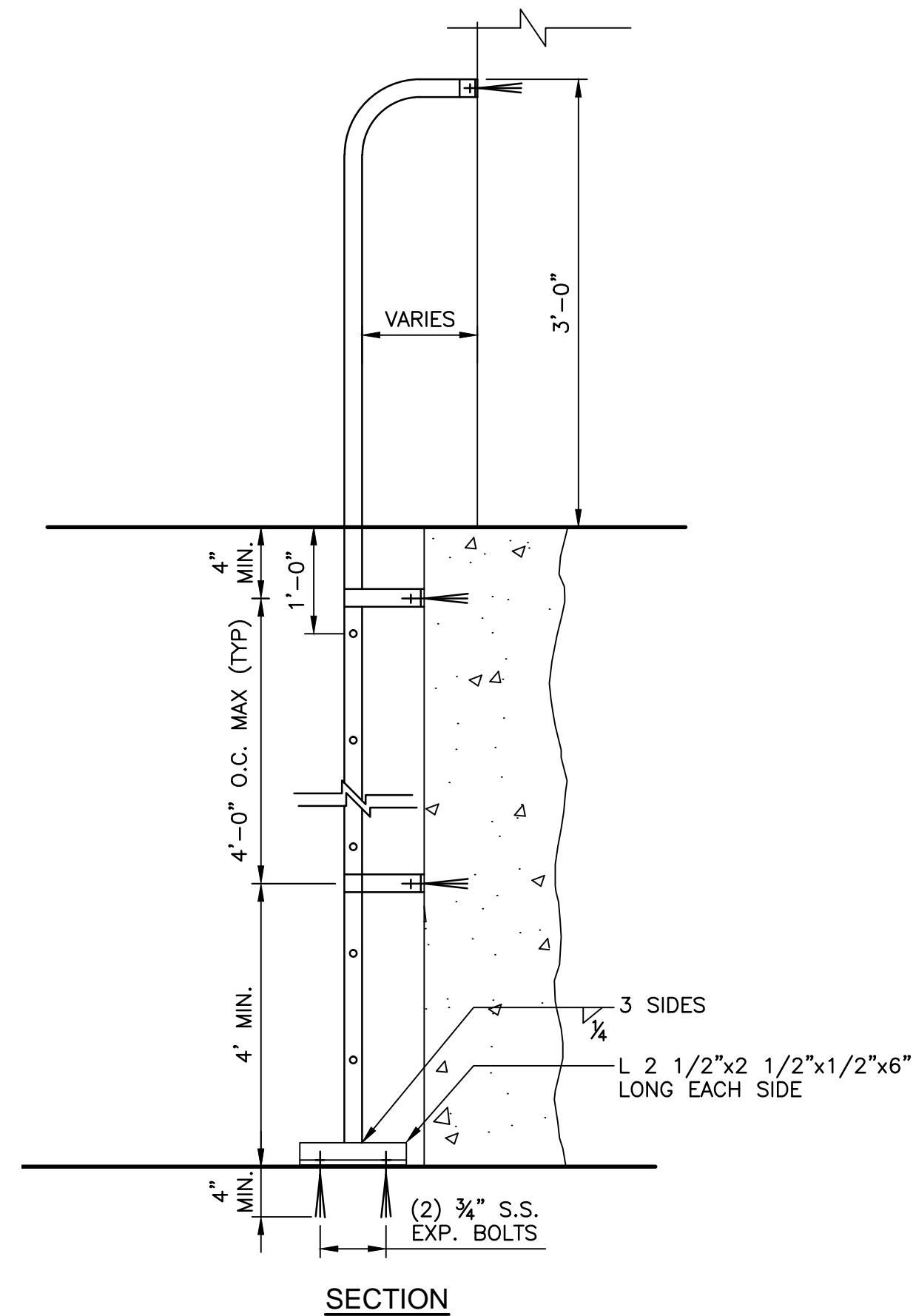
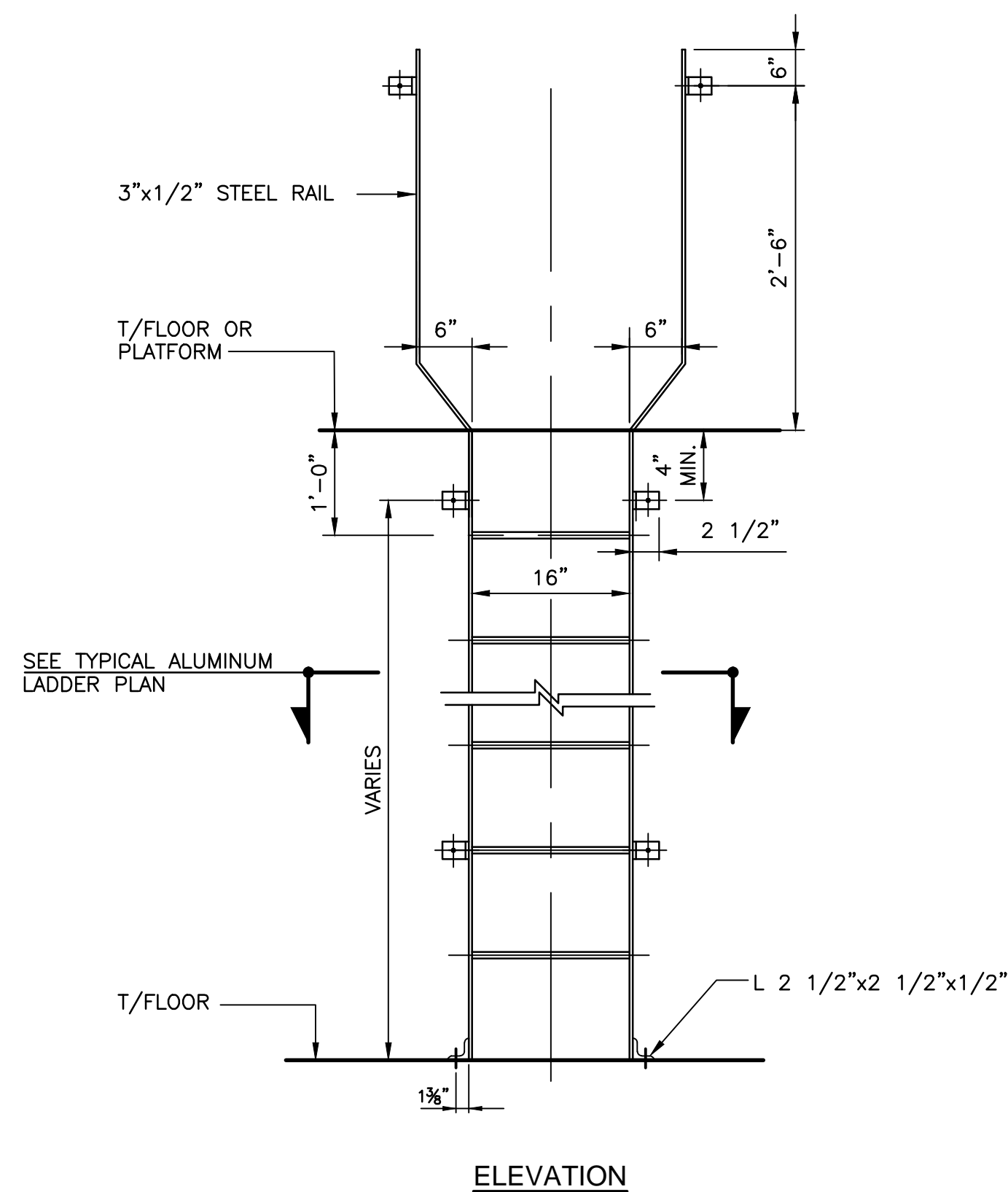
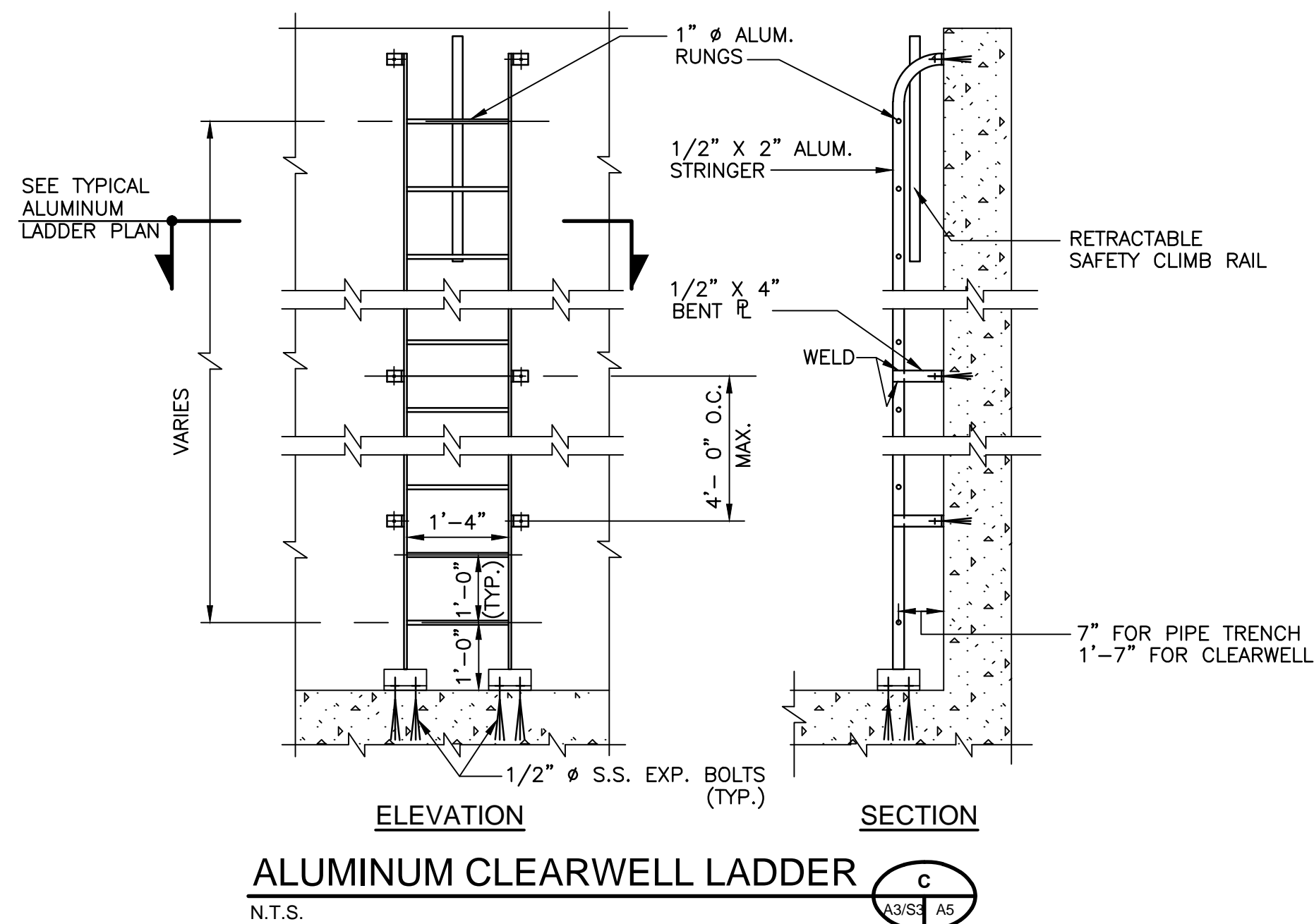
**INTERIOR ALUMINUM SINGLE
LEAF ACCESS HATCH DETAIL**
N.T.S.



TYPICAL SURFACE MOUNTED GUARDRAIL DETAIL
N.T.S.

STEEL ANGLE LOOSE LINTEL SCHEDULE		
MAXIMUM MASONRY OPENINGS	WALL THICKNESS	
	8" WALL	12" WALL
3'-0"	2-JL 3 1/2 x 3 1/2 x 1/4	3-JJL 3 1/2 x 3 1/2 x 1/4
4'-0"	2-JL 4 x 3 1/2 x 1/4	3-JJL 4 x 3 1/2 x 1/4
5'-0"	2-JL 5 x 3 1/2 x 1/4	3-JJL 4 1/2 x 3 1/2 x 1/4
6'-0"	2-JL 5 x 3 1/2 x 1/4	3-JJL 5 x 3 1/2 x 1/4
8'-0"	2-JL 6 x 3 1/2 x 1/4	3-JJL 6 x 3 1/2 x 1/4

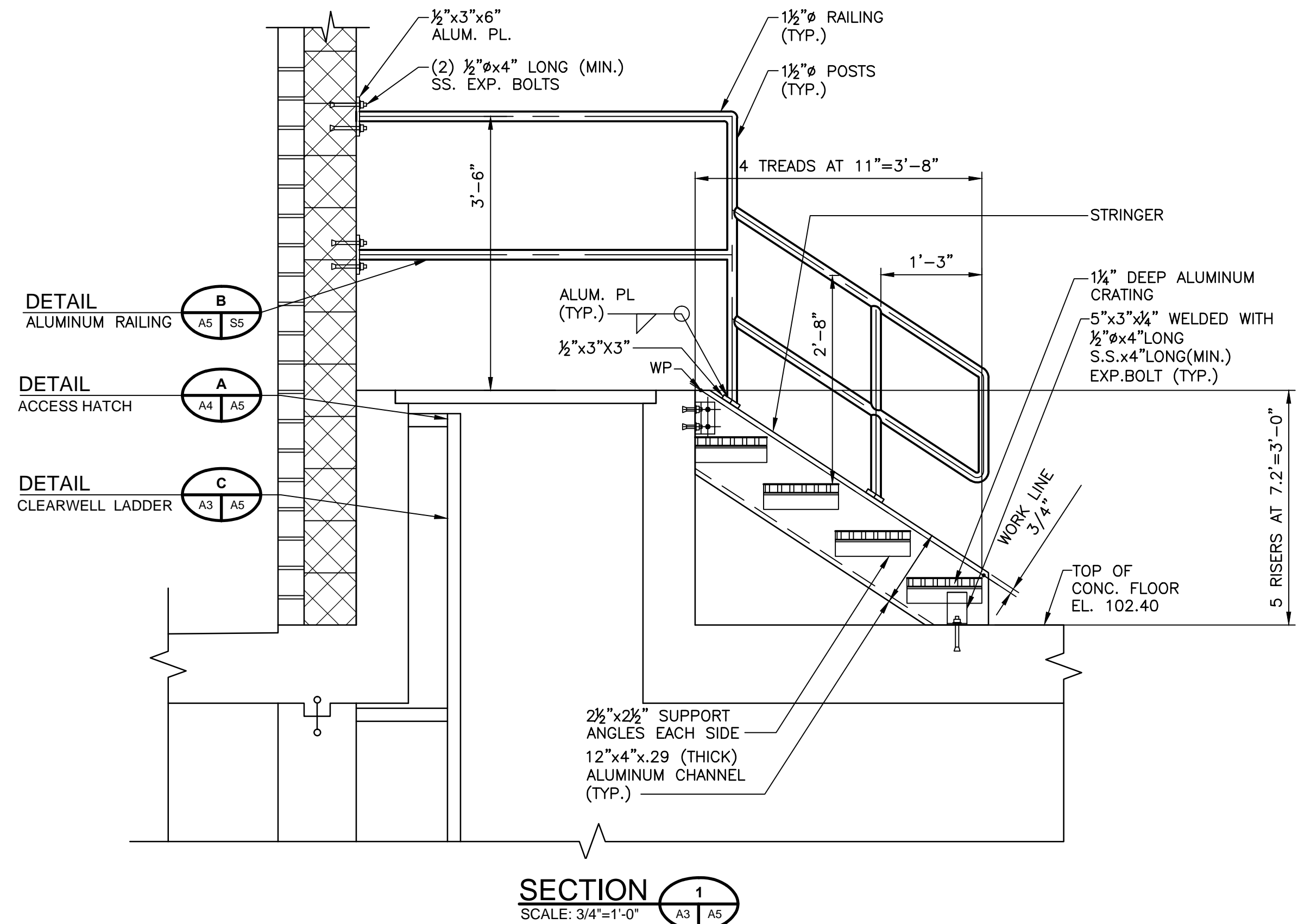
- PROVIDE AND INSTALL LINTEL ANGLES FOR MASONRY OPENINGS IN ACCORDANCE WITH THE SCHEDULE ABOVE.
- INSTALL LONG LEG VERTICAL SEE ARCHITECTURAL DRAWINGS FOR LOCATION.
- PROVIDE 6" MINIMUM BEARING AT EACH END BUT NOT LESS THAN 1" PER FOOT OF SPAN. FILL 2 COURSES OF MASONRY BELOW BEARING WITH MORTAR.
- WHERE MINIMUM BEARING CANNOT BE PROVIDED, ATTACH SECURELY TO ADJACENT STRUCTURAL MEMBERS OR PROVIDE SEPARATE SUPPORTS.
- WHERE LINTELS OCCUR IN EXTERIOR WALLS, MINIMUM THICKNESS SHALL BE 5/16" AND ANGLES SHALL BE HOT DIPPED GALVANIZED.
- WHERE WALL THICKNESS EXCEEDS 12" PROVIDE ONE ADDITIONAL ANGLE FOR EACH ADDITIONAL 4" OF WALL.



ALUMINUM PIPE TRENCH LADDER

N.T.S.

D
A3/S3 A5



NO.	DATE	REVISION	INT.



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TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

PACKED TOWER BUILDING DETAILS II ARCHITECTURAL	
--	--

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: AS NOTED

DRAWING NO. A5

CODES AND STANDARDS:

1. MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, ASCE 7–05.
2. BUILDING CODE REQUIREMENTS FOR CONCRETE STRUCTURES, ACI 318–08.
3. BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES, ACI 530–99/ASLE 5–99/TMS 402–99.

CONSTRUCTION:

- 1.THE CONTRACTOR SHALL EXAMINE AND VERIFY ALL EXISTING FIELD CONDITIONS. VERIFY ALL DIMENSIONS OF EXISTING FACILITIES. IF THE FIELD CONDITIONS DIFFER FROM THOSE SHOWN ON THE PLANS, THE CONTRACTOR SHALL USE THE FIELD CONDITIONS AS APPROVED BY THE ENGINEER. ALL FIELD CONDITIONS AND DIMENSIONS SHALL BE NOTED ON THE DRAWING SUBMITTED FOR REVIEW PRIOR TO CONSTRUCTION.
- 2.THE CONTRACTOR SHALL VERIFY ALL SIZES AND LOCATIONS OF ALL MECHANICAL OR ARCHITECTURAL OPENINGS WITH THE SHOP DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ALL OPENINGS AND SLEEVES AND COORDINATE THE OPENINGS ON THE SHOP DRAWINGS PRIOR TO CONSTRUCTION.
- 3.THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE ARCHITECTURAL DRAWINGS AND CONTRACT SPECIFICATIONS.
- 4.THE CONTRACTOR SHALL PERFORM ALL THE NECESSARY SHORING AS REQUIRED AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO SAFEGUARD THE WORK AT ALL TIMES DURING CONSTRUCTION.
- 5.PERFORM DEMOLITION OF EXISTING CONSTRUCTION, ROADWAY, ETC. AS REQUIRED TO CONSTRUCT THE NEW WORK.

FOUNDATION:

1. FOOTING TO BEAR ON LEVEL UNDISTURBED SOIL, THE MINIMUM ALLOWABLE SOIL BEARING CAPACITY IS COMPUTED AS 3 TONS PER SQUARE FOOT PER GEOTECH REPORT, DATED JUNE 26, 2014.
2. KEEP FOOTING BOTTOMS WELL DRAINED UNTIL FOOTINGS ARE IN PLACE, PUMP AS REQUIRED.
3. NO BACKFILLING SHALL BE PERMITTED UNTIL FOOTING CONCRETE HAS ATTAINED SPECIFIED 28–DAY STRENGTH.
4. EXCAVATION ADJACENT TO EXISTING OR NEW STRUCTURE SHALL BE PROTECTED WITH SHEETING, SHORING AND BRACING WHEREVER REQUIRED AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN AND INSTALLATION OF SAME SUBJECT TO THE REVIEW OF THE ENGINEER.
5. CONTRACTOR SHALL INVESTIGATE ACTUAL LOCATIONS OF UNDERGROUND PIPING AND UTILITIES BEFORE EXCAVATING, AND ADVISE THE ENGINEER OF ANY VARIATIONS.
6. CONTRACTOR SHALL PREPARE AND SUBMIT TO THE ENGINEER A DEWATERING REPORT AND RECOMMENDATIONS PRIOR TO ANY SITE EXCAVATION.
7. LOCATE AND PROTECT EXISTING SCRUBBER WATER PIPE AS REQUIRED DURING CONSTRUCTION OF NEW WORK.
8. ALL EXCAVATED AREAS SHALL BE COMPACTED TO 95% PROCTOR AND INSPECTED BY THE ENGINEER IN CONJUNCTION WITH SOILS COMPACTION TESTS BEFORE PLACING FOUNDATION.

CONCRETE:

- 1.DESIGN, MATERIALS AND METHOD OF CONSTRUCTION SHALL COMPLY WITH THE REQUIREMENTS OF ACI 318 LATEST EDITION AND AS SPECIFIED IN THE CONTRACT SPECIFICATIONS.
- 2.ALL CONCRETE SHALL BE NORMAL WEIGHT CONCRETE HAVING A WEIGHT OF 145 LBS/CU. FT.
- 3.MINIMUM COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS TO BE 4,000 PSI.
- 4.FOUR TEST CYLINDERS SHALL BE MOLDED FOR EACH 50 CU. YDS. OR FRACTION THEREOF EACH TYPE OF CONCRETE PLACED IN ONE DAY’S CONCRETING AND SHALL BE TESTED FOR STANDARD ASTM SPECIFICATION AND AS SPECIFIED.
- 5.ALL BAR REINFORCEMENT SHALL BE DEFORMED TYPE BULLET STEEL CONFORMING TO ASTM A615 GRADE 60 EPOXY COATED.
- 6.WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 WITH MINIMUM YIELD STRENGTH OF 65,000 PSI.

MASONRY:



- 1.ALL CONCRETE MASONRY WORK SHALL BE AS SPECIFIED AND SHALL CONFORM TO STRUCTURES (ACI–530) LATEST EDITION.
- 2.ALL CONCRETE MASONRY UNITS SHALL CONFORM TO ASTM C90, GRADE S, TYPE 1. NORMAL WEIGHT, WITH A MINIMUM COMPRESSED STRENGTH OF 2,000 PSI (F’M = 1,400 PSI).
- 3.ALL MORTAR SHALL BE TYPE M MORTAR CONFORMING TO ASTM C270.
- 4.PROVIDE CONTROL JOINTS IN WALLS AT SPACING NOT EXCEEDING 25 FEET.

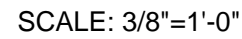
MASONRY WALL REINFORCEMENT:

- 1.MINIMUM VERTICAL REINFORCEMENT SHALL BE #4 BAR AT 32–INCH O.C.
- 2.HORIZONTAL REINFORCEMENT SHALL BE LADDER TYPE AT EVERY ALTERNATE LAYER #220 LADDER MESH BY HOHMANN AND BERNARD OR EQUAL.

STEEL JOIST:

1. ALL STEEL JOIST SHALL BE DETAILED, FABRICATED AND INSTALLED FOLLOWING THE REQUIREMENTS OF STEEL JOIST INSTITUTE (SJI).

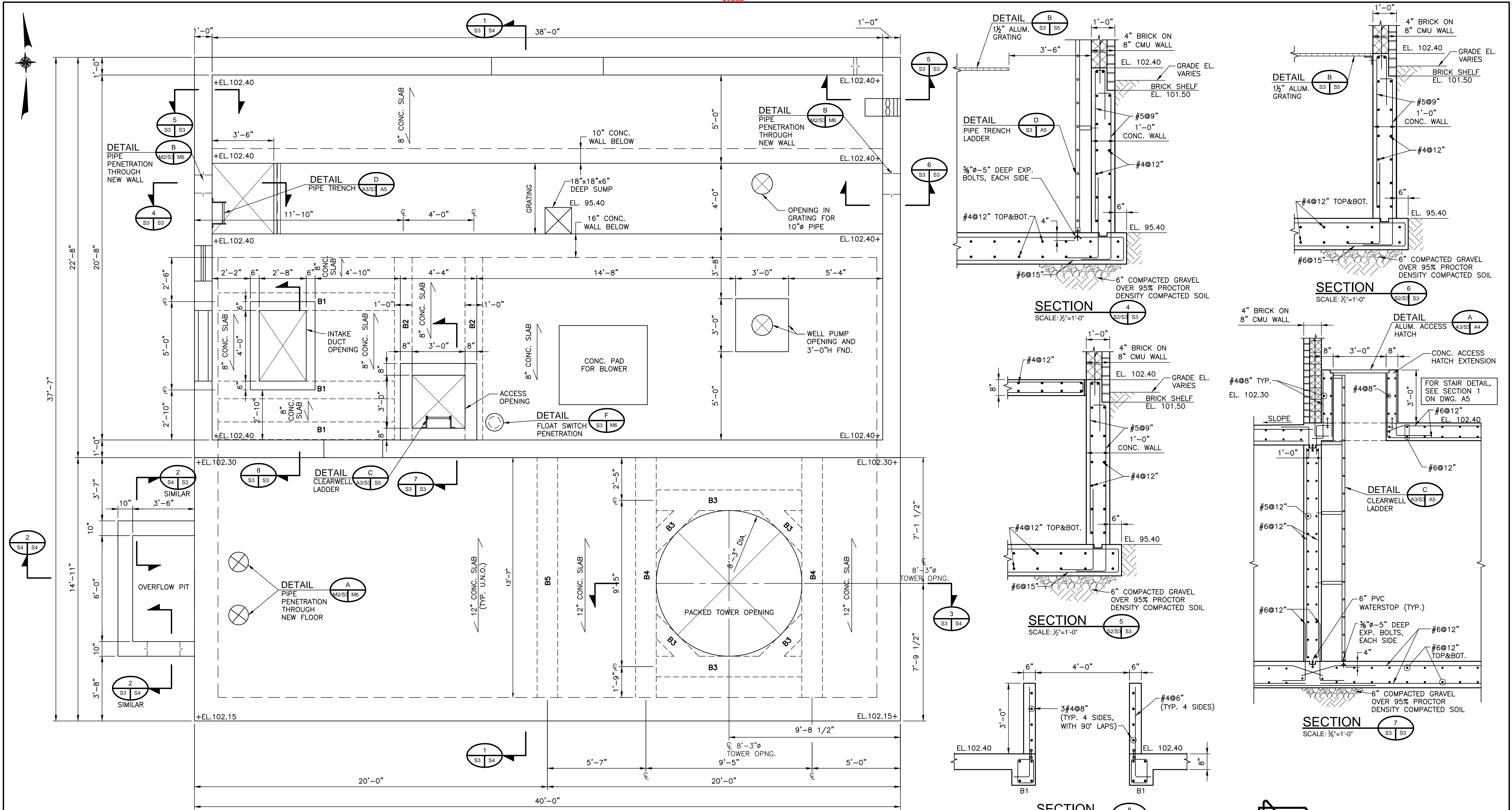
					UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.		 <div>D&B ENGINEERS AND ARCHITECTS, P.C. <small>KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS</small></div>	TOWN OF HEMPSTEAD DEPARTMENT OF WATER		GENERAL NOTES GENERAL	PROJECT NO. 3402		DRAWING NO. S1	
					PROJECT ENGINEER: SL	DRAWN BY: JEZ		NASSAU COUNTY	NEW YORK		DATE: NOVEMBER 2014			
					DESIGNED BY: NS	CHECKED BY: WDM		LEVITTOWN WATER DISTRICT			SCALE: N.T.S.			
NO.	DATE	REVISION	INT.					CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13						



<p align="center">TOWN OF HEMPSTEAD DEPARTMENT OF WATER</p>	
<p>NASSAU COUNTY</p>	<p align="right">NEW YORK</p>
<p align="center">LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13</p>	

PROJECT NO.	3402
DATE:	NOVEMBER 2014
SCALE:	3/8"=1'-0"

S2

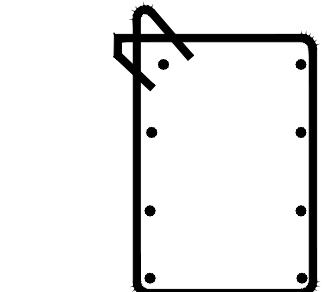


SLAB PLAN
SCALE: 3/8"=1'-0"

NOTES:

1. GRATING SHOWN THUS (—) TO BE GALVANIZED STEEL GRATING WITH 1 1/2"x3/4" BEARING BARS AT 13 1/8" O.C., AND CROSS BARS AT 6'-0" O.C. (MAX.) USE GRATING BY IKG BORDEN, OR APPROVED EQUAL.
2. FOR MISCELLANEOUS DETAILS, SEE DWG. NO. S5.
3. COORDINATE PIPE PENETRATIONS WITH MECHANICAL DWGS.

CONCRETE BEAM SCHEDULE									
BEAM MARK	SIZE		BOTTOM REINFORCEMENT	TOP REINFORCEMENT		STIRRUPS	NO. SIZE & SPACING		
	WIDTH	DEPTH		CONTINUOUS	ADDITIONAL BARS LEFT END		ADDITIONAL BARS RIGHT END	NO. SIZE & SPACING	TYPE
B1	12"	18"	3 #6	2 #6 [2'-0"]	2 #6 [2'-0"]	#4@8"			1
B2	12"	16"	3 #6	2 #6 [2'-0"]	2 #6 [2'-0"]	#4@8"			1
B3	12"	16"	3 #6	NONE	NONE	#4@8"			1
B4	14"	20"	5 #6	3 #6	2 #6 [2'-0"]	#4@8"			1
B5?	14"	20"	5 #6	3 #6	2 #6 [2'-0"]	#4@8"			1



TYPE 1 STIRRUP
SCALE: N.T.S.

NO.	DATE	REVISION	INT.



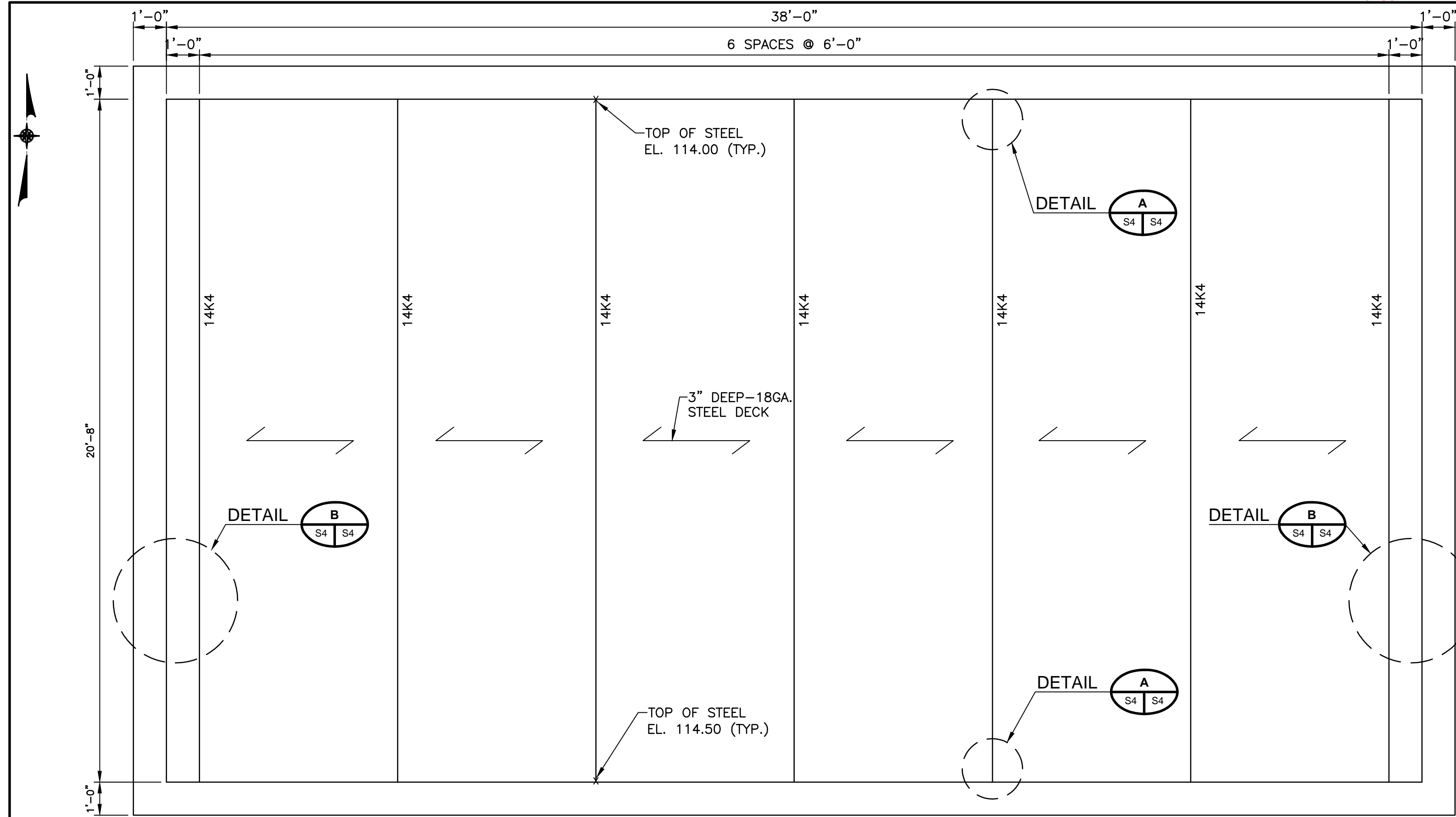
UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			
PROJECT ENGINEER:	SL	DRAWN BY:	JEZ
DESIGNED BY:	NN	CHECKED BY:	WDM

db D&B ENGINEERS AND ARCHITECTS, P.C.
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

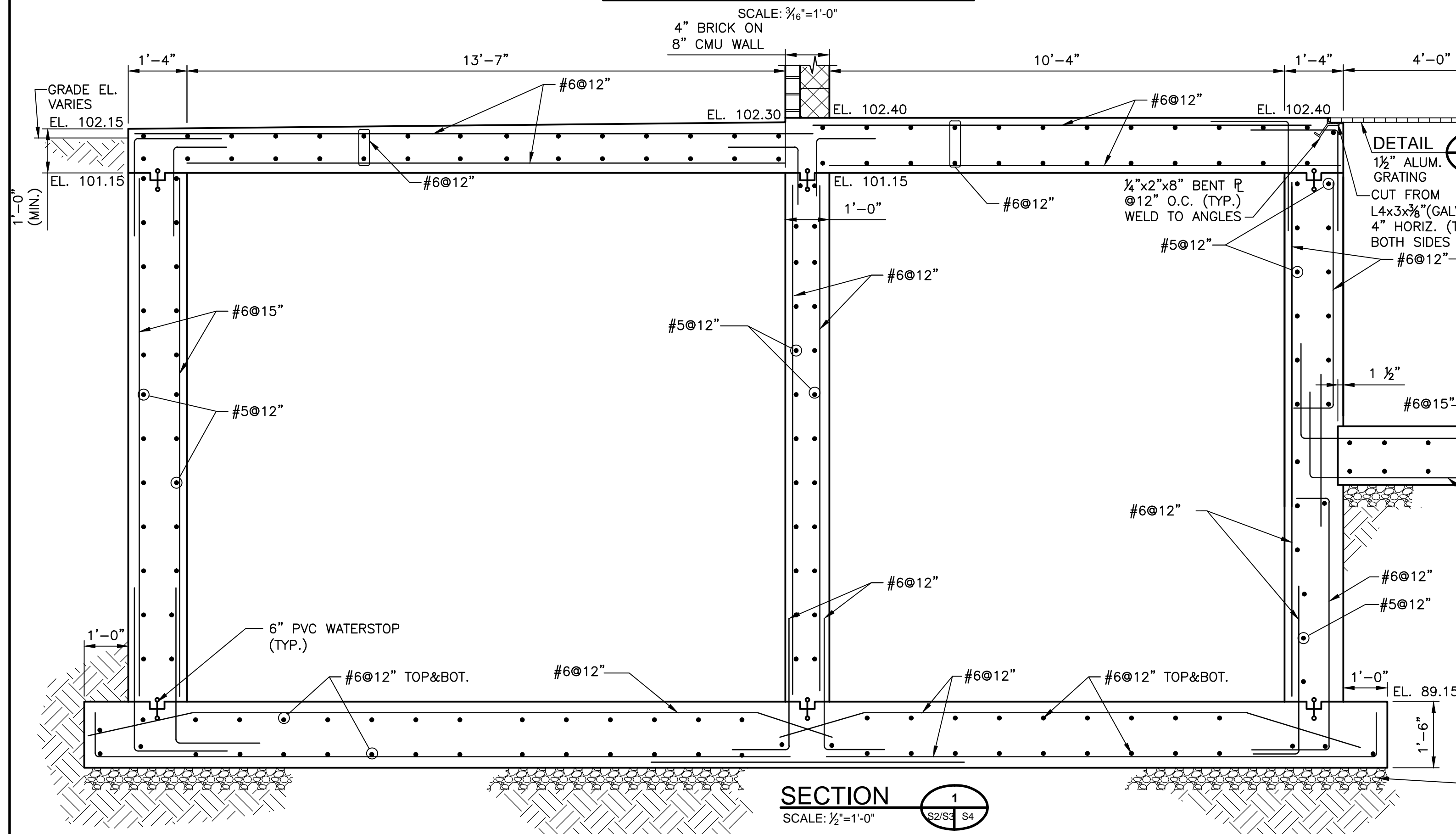
TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
NASSAU COUNTY NEW YORK
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13

PACKED TOWER BUILDING
SLAB PLAN AND SECTIONS
STRUCTURAL

PROJECT NO. 3402	DRAWING NO. S3
DATE: NOVEMBER 2014	
SCALE: 3/8"=1'-0"	



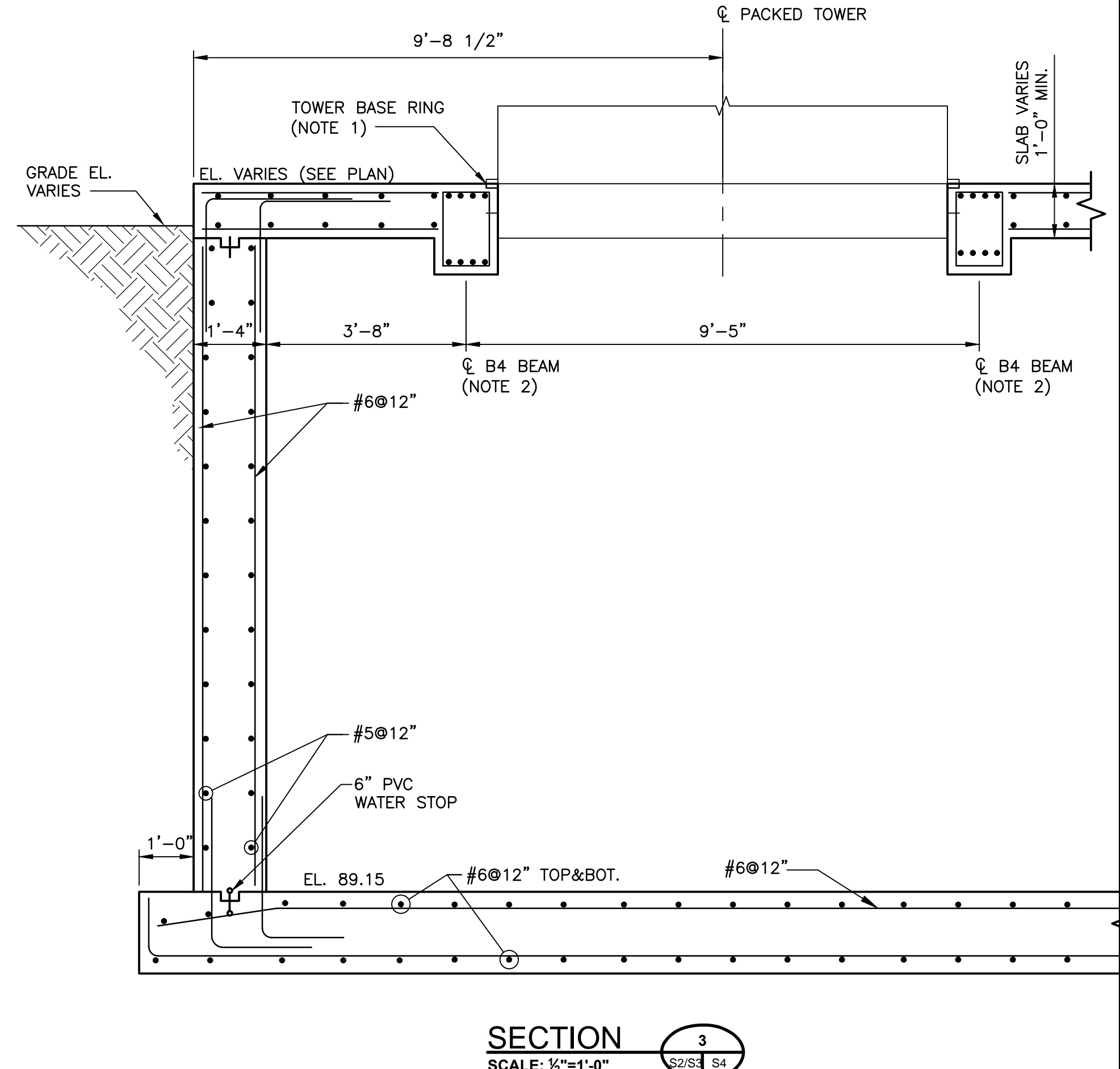
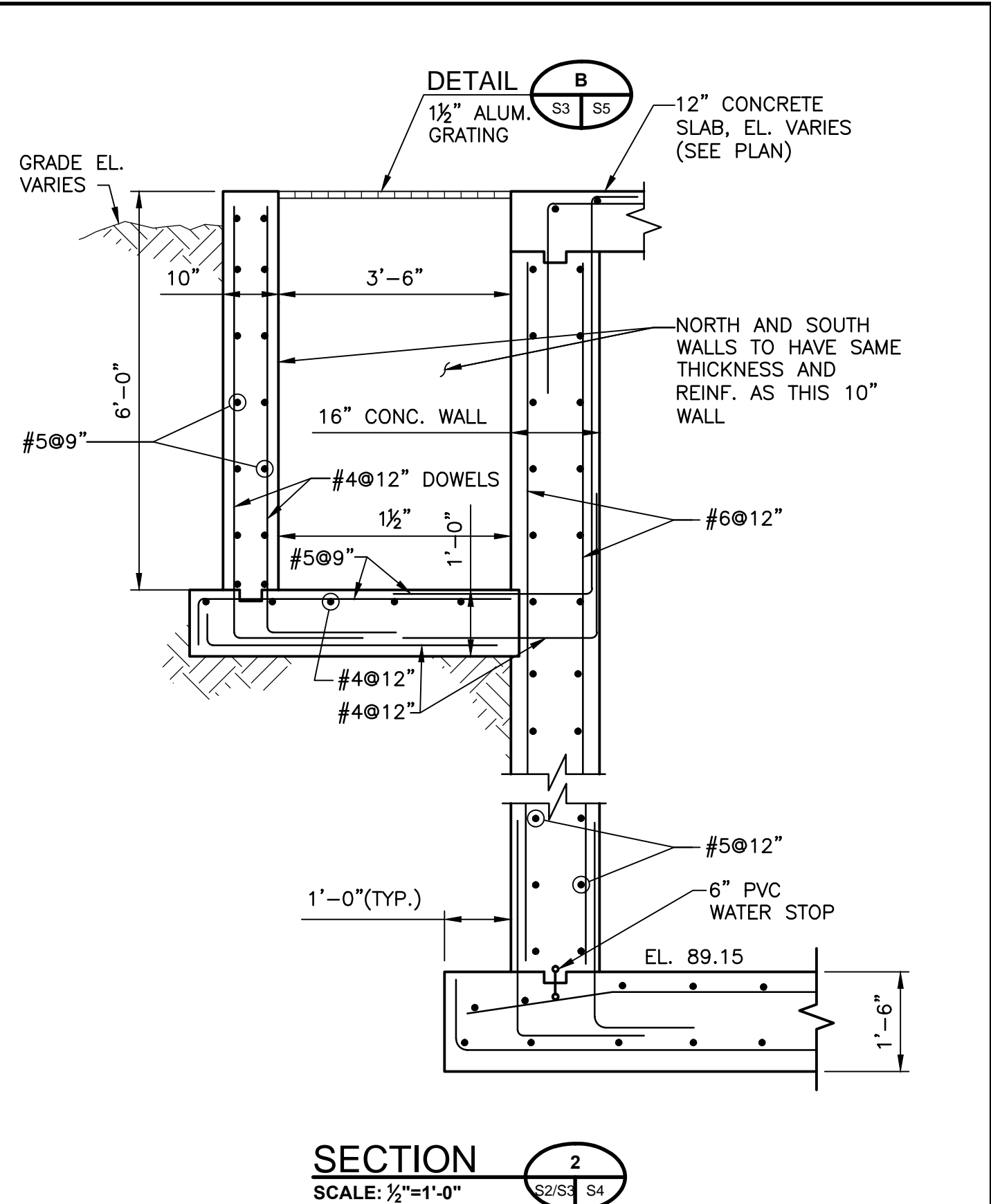
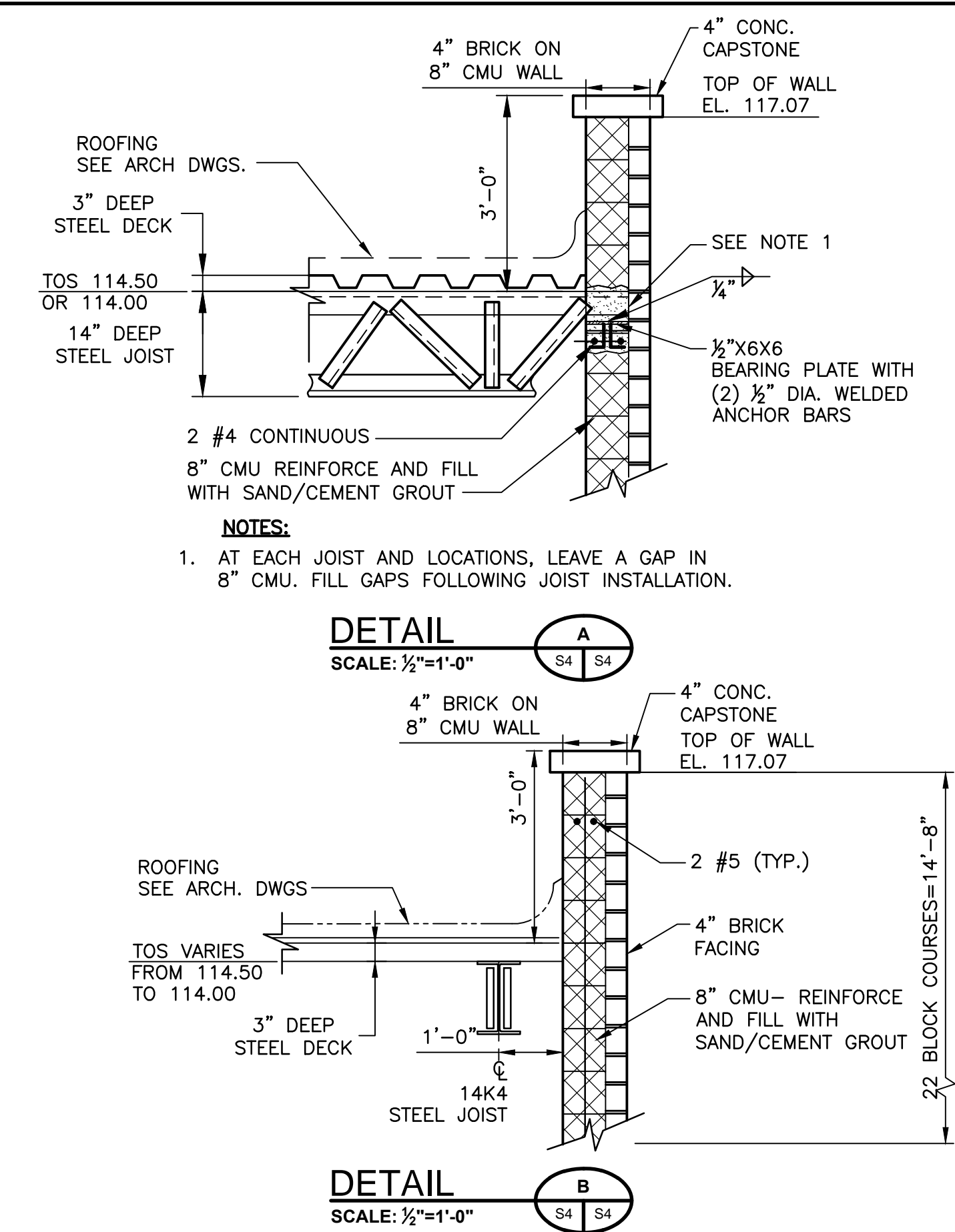
WELL 13 ROOF FRAMING PLAN



- NOTES:
- GC SHALL COORDINATE TOWER BASE RING, BLOWER PAD AND DUCT PENETRATION WITH APPROVED EQUIPMENT SHOP DRAWINGS.
 - SEE CONCRETE BEAM SCHEDULE ON DWG. S3.

6" COMPACTED GRAVEL, OVER 95% PROCTOR DENSITY COMPACTED SOIL (TYP.)

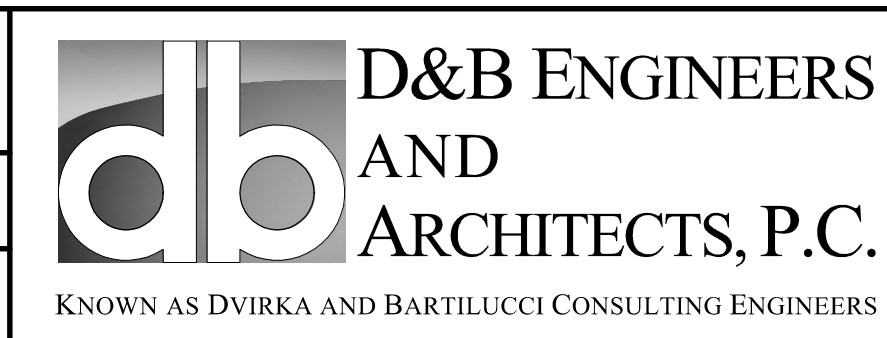
TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
NASSAU COUNTY NEW YORK
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13



NO.	DATE	REVISION	INT.



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PROJECT ENGINEER:	SL	DRAWN BY:	JEZ
DESIGNED BY:	NN	CHECKED BY:	WDM



<div>PACKED TOWER BUILDING</div> <div>ROOF FRAMING PLAN, SECTIONS AND DETAILS</div> <div>STRUCTURAL</div>	<div>PROJECT NO.</div> <div>3402</div>	<div>DRAWING NO.</div> <div>S4</div>
	<div>DATE:</div> <div>NOVEMBER 2014</div>	
	<div>SCALE:</div> <div>AS SHOWN</div>	

PACKED TOWER BUILDING
ROOF FRAMING PLAN, SECTIONS AND DETAILS
STRUCTURAL



N.T.S.



TYPICAL FOR OPENINGS IN A
AND WALLS (UNLESS NOTED)



- METAL SCUPPER



N.T.S



CONCRETE WALL



N.T.S.



N.T.S.



N.T.S.

Table values apply for the following conditions:

- 1 Normal weight concrete with $f_c = 4000$ psi @ 28 days.
- 2 ASTM A615 Grade 60 Epoxy coated deformed steel reinforcing bars
- 3 Concrete cover min 2", and clear spacing between bars min. 4x bar diameter (incl. splices)
- 4 'Top' bars are defined as horizontal bars with more than 12" of concrete cast in the member below the bars.
- 5 All wall bars are classified as 'Other bars'
- 6 Unless otherwise approved or shown on the drawings all splices shall be staggered such that not more than 50% of bars are spliced at any location.

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N.T.S.

The seal is circular with the text "STATE OF NEW YORK" at the top and "LICENSED PROFESSIONAL ENGINEER" at the bottom. In the center is the coat of arms of the State of New York, featuring a figure holding a staff with a serpent entwined around it, and a figure holding a sword. Below the coat of arms is the text "No. 072392". The name "WILLIAM D. MERKLE" is written in a semi-circle above the coat of arms. A signature is written across the seal.

PROJECT ENGINEER:

SL

DRAWN BY:

DESIGNED BY:

NN

CHECKED BY _____

1



KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NASSAU COUNTY

NEW YORK

LEVITTOWN WATER DISTRICT

CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13

PACKED TOWER BUILDING

DETAILS

STRUCTURAL

3402

DATE:

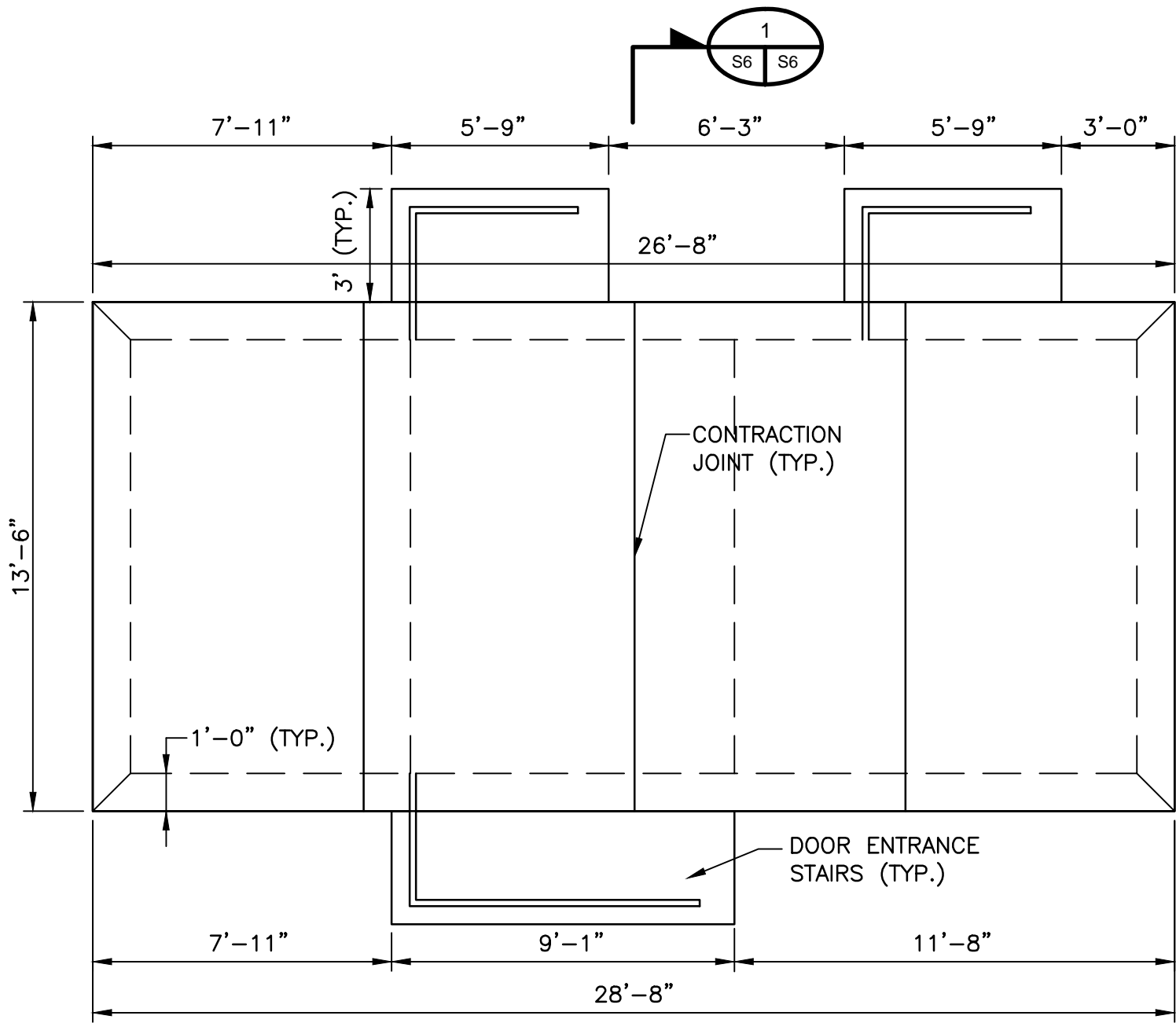
NOVEMBER 2014

SCALE

AS SHOWN

DRAWING NO.

S5



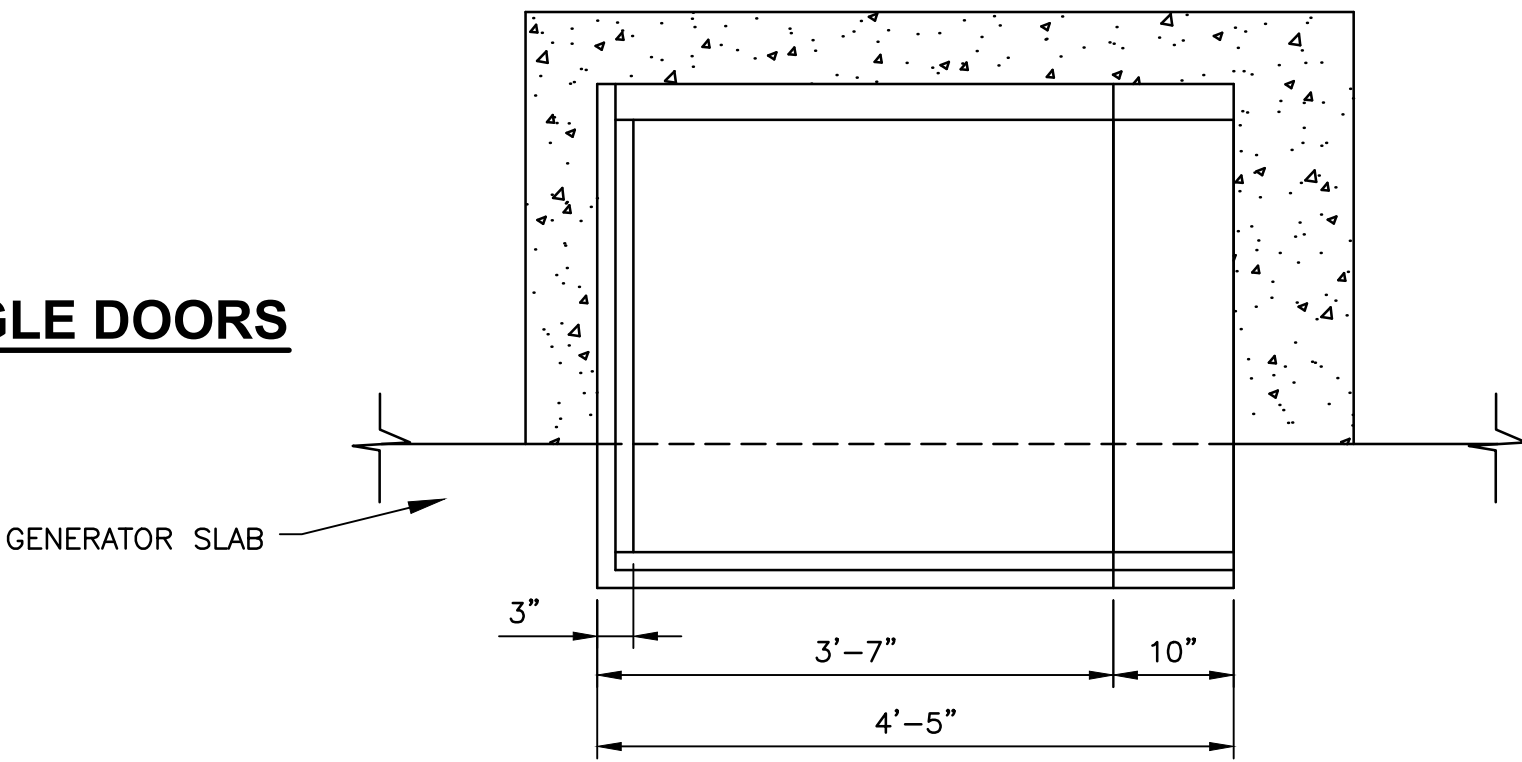
PLAN

SCALE: 1/4"=1'-0"

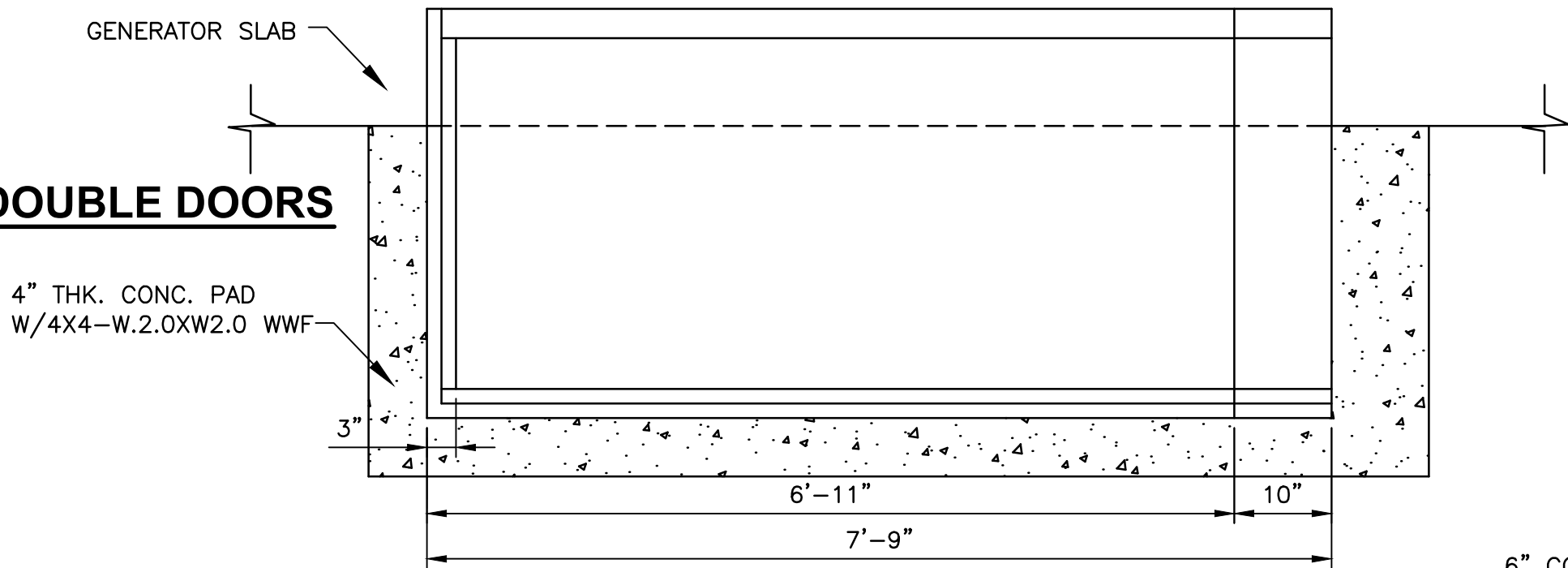
NOTES:

1. FOR LOCATION PLAN SEE DRAWING 2
2. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GR. 60
3. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A-185 AND HAVE A MINIMUM ULTIMATE STRENGTH OF 65,000 psi
4. CONCRETE SHALL BE NORMAL WIEGHT 145 lb/c ft. WITH COMPRESSIVE STRENGTH OF 4000 psi AT 28 DAYS.
5. PROVIDE CONTRACTION JOINTS AT 10'-0" ON CENTER (MAX) IN THE GENERATOR SET SUPPORT PAD
6. CONCRETE CONSTRUCTION SHALL CONFORM THE LATEST SPECIFICATION OF THE AMERICAN CONCRETE INSTITUTE ACI 318
7. SEQUENCE OF OPERATION:
 - a) EXCAVATE SOIL FOR GENERATOR, AND DOOR ENTRANCE PADS. FOR DOOR ENTRANCE PAD LOCATIONS COORDINATE WITH THE GENERATOR SET DRAWINGS. THE PADS SHOULD BE 2 ft. WIDER THEN THE DOOR WIDTHS.
 - b) COMPACT SOIL AT THE BOTTOM OF THE EXCAVATIONS. PROVIDE 12" (6" FOR DOOR PADS) OF GRAVEL AND COMPACT.
 - c) CONSTRUCT GENERATOR PAD AND THE DOOR ENTRANCE PADS PER DETAILS SHOWN. WET CURE FOR 7 DAYS.
 - d) FILL CONTRACTION JOINTS IN THE GENERATOR SET PAD WITH FLEXIBLE JOINT SEALANT SIKAFLEX-15LM OR EQUAL.

SINGLE DOORS

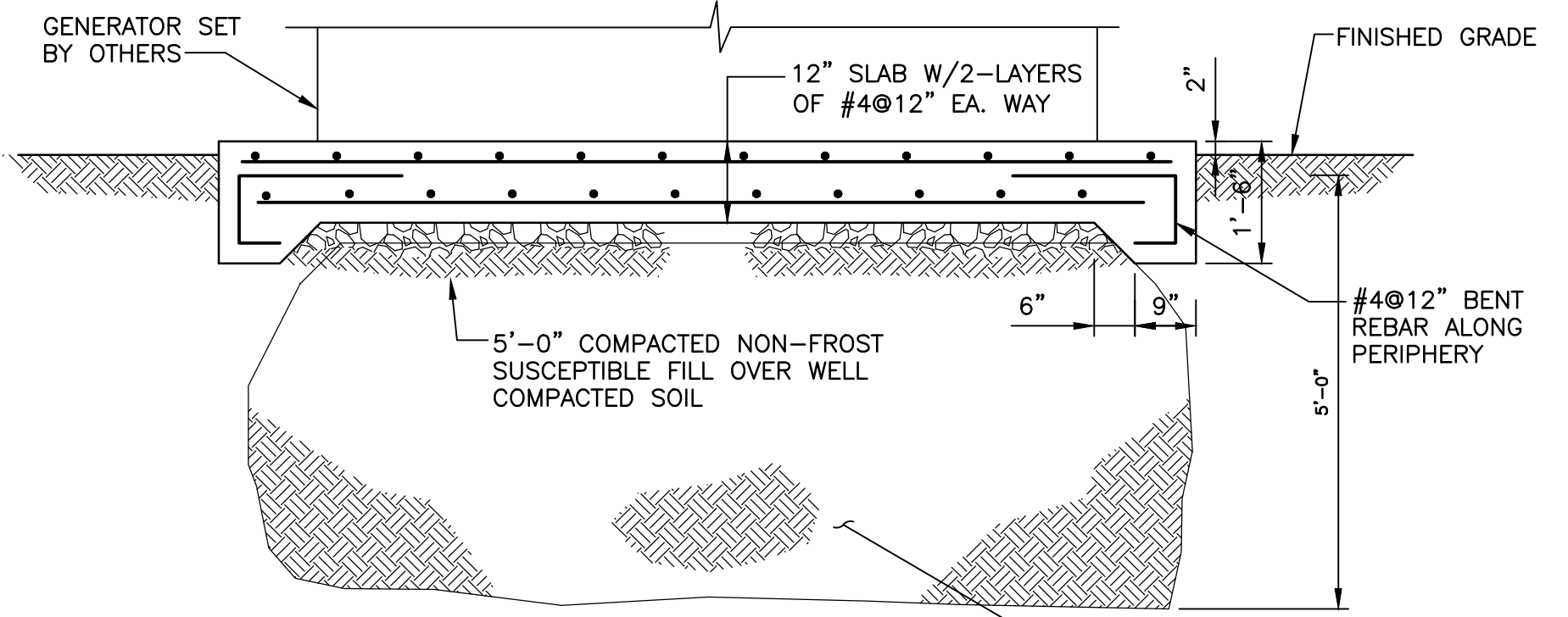


DOUBLE DOORS



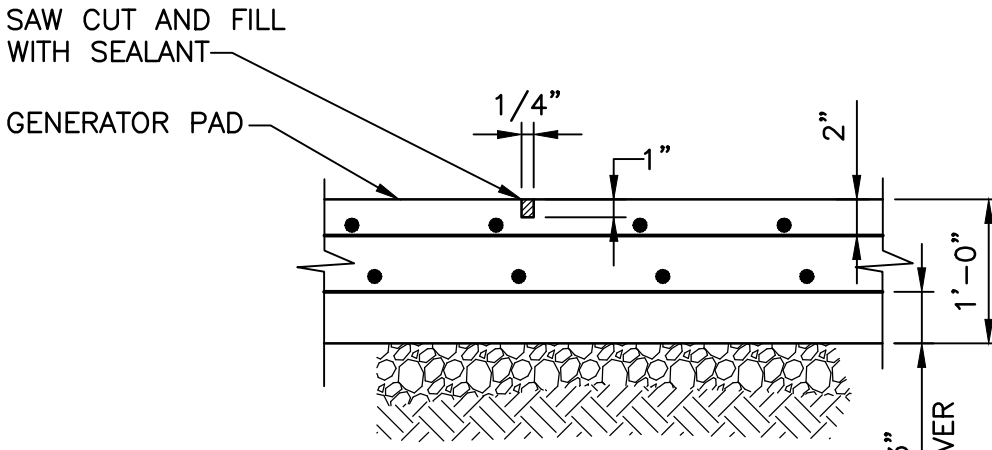
TOP VIEW

3/4"=1'-0"



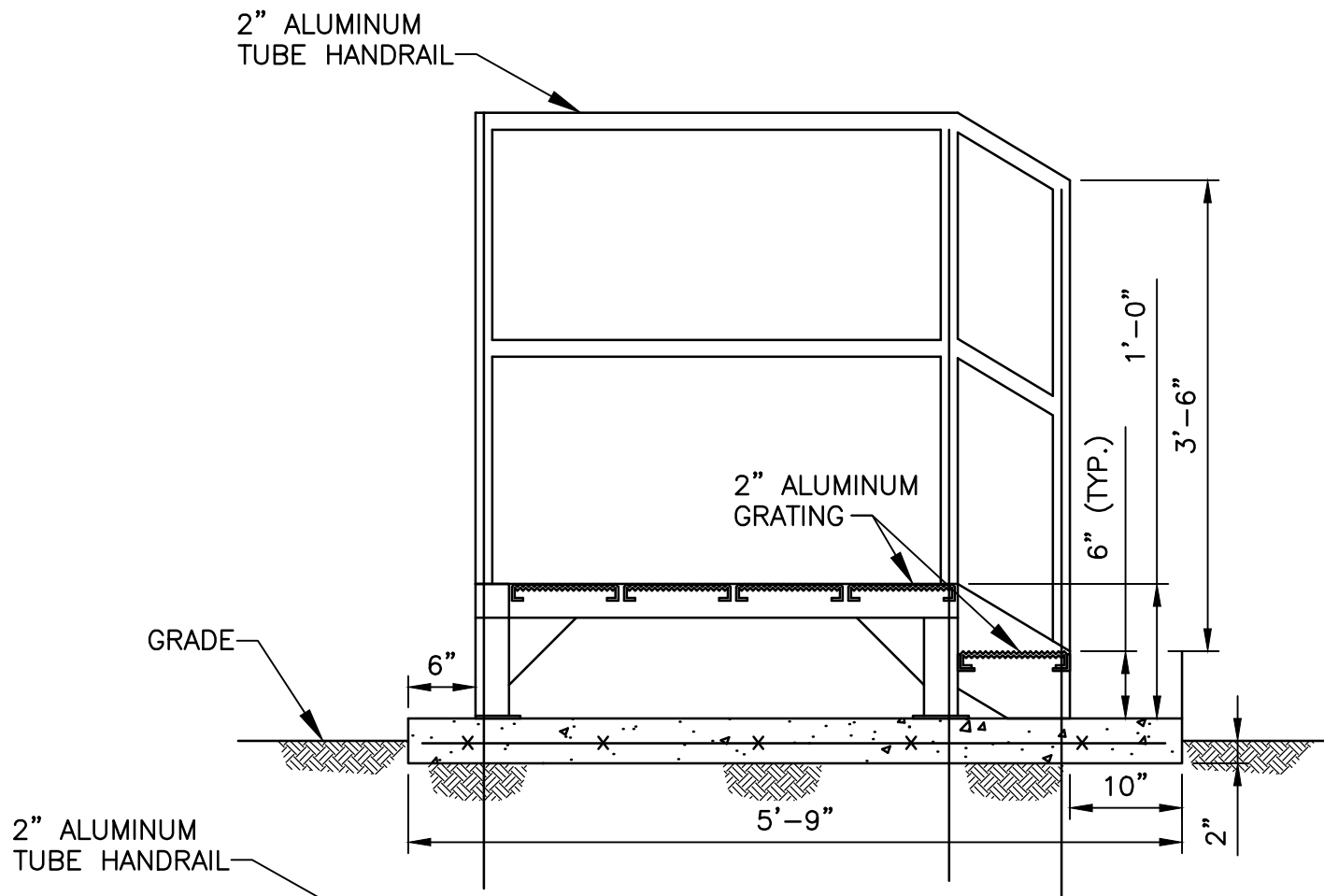
SECTION

1/2"=1'-0"



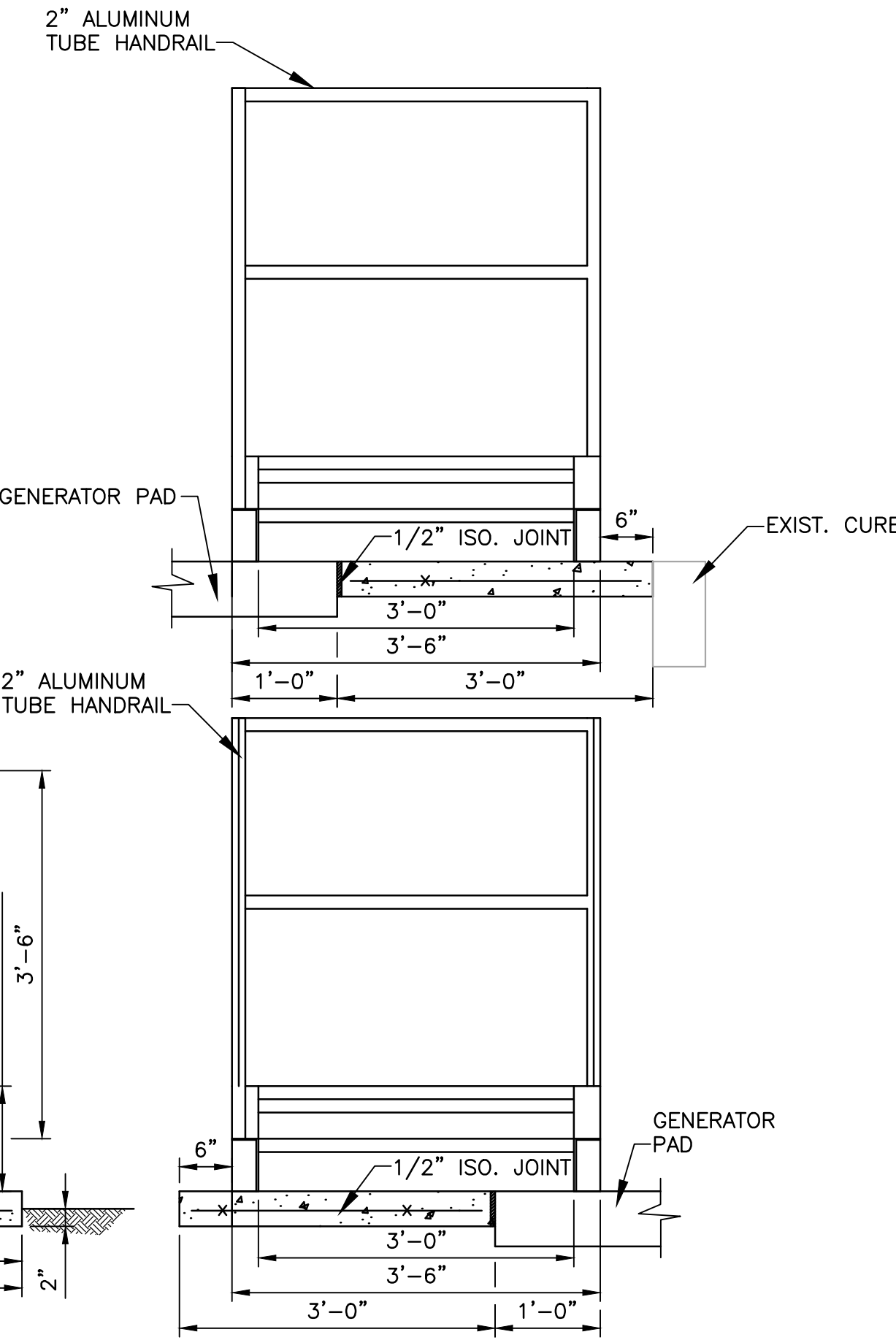
CONTRACTION JOINT DETAIL

N.T.S.



SIDE VIEW

3/4"=1'-0"



FRONT VIEW

3/4"=1'-0"

ALUMINUM STAIRS WITH LANDINGS

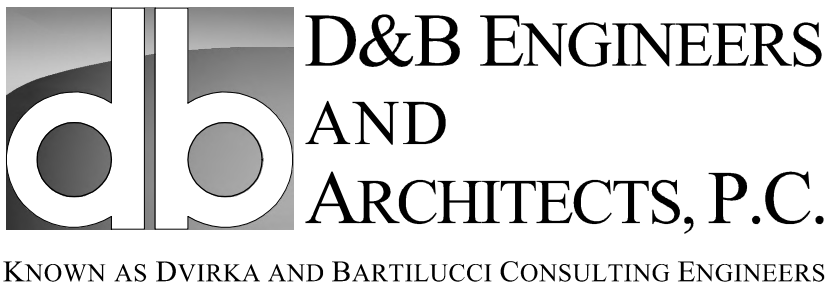
NOTES:

1. THE ALUMINUM STAIRS SHALL BE PROVIDED BY THE GENERATOR MANUFACTURER.
2. THE EXACT SIZE, SHAPE, AND LOCATIONS OF ALL ALUMINUM STAIR STAINLESS STEEL ANCHORAGE SHALL BE DESIGNED BY THE GENERATOR MANUFACTURER AND APPROVED BY THE ENGINEER, FOLLOWING THE APPROVAL OF EQUIPMENT SHOP DRAWINGS.
3. ANCHORAGE SHALL BE INSTALLED AS PER MANUFACTURER'S DIRECTIONS.

NO.	DATE	REVISION	INT.



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PROJECT ENGINEER:		DRAWN BY:	
SL		LVG	
DESIGNED BY:		CHECKED BY:	
MN		WDM	



TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

GENERATOR SLAB AND STAIRS
PLANS, SECTIONS, AND DETAILS

STRUCTURAL

PROJECT NO. 3402	S6
DATE: NOVEMBER 2014	
SCALE: AS NOTED	

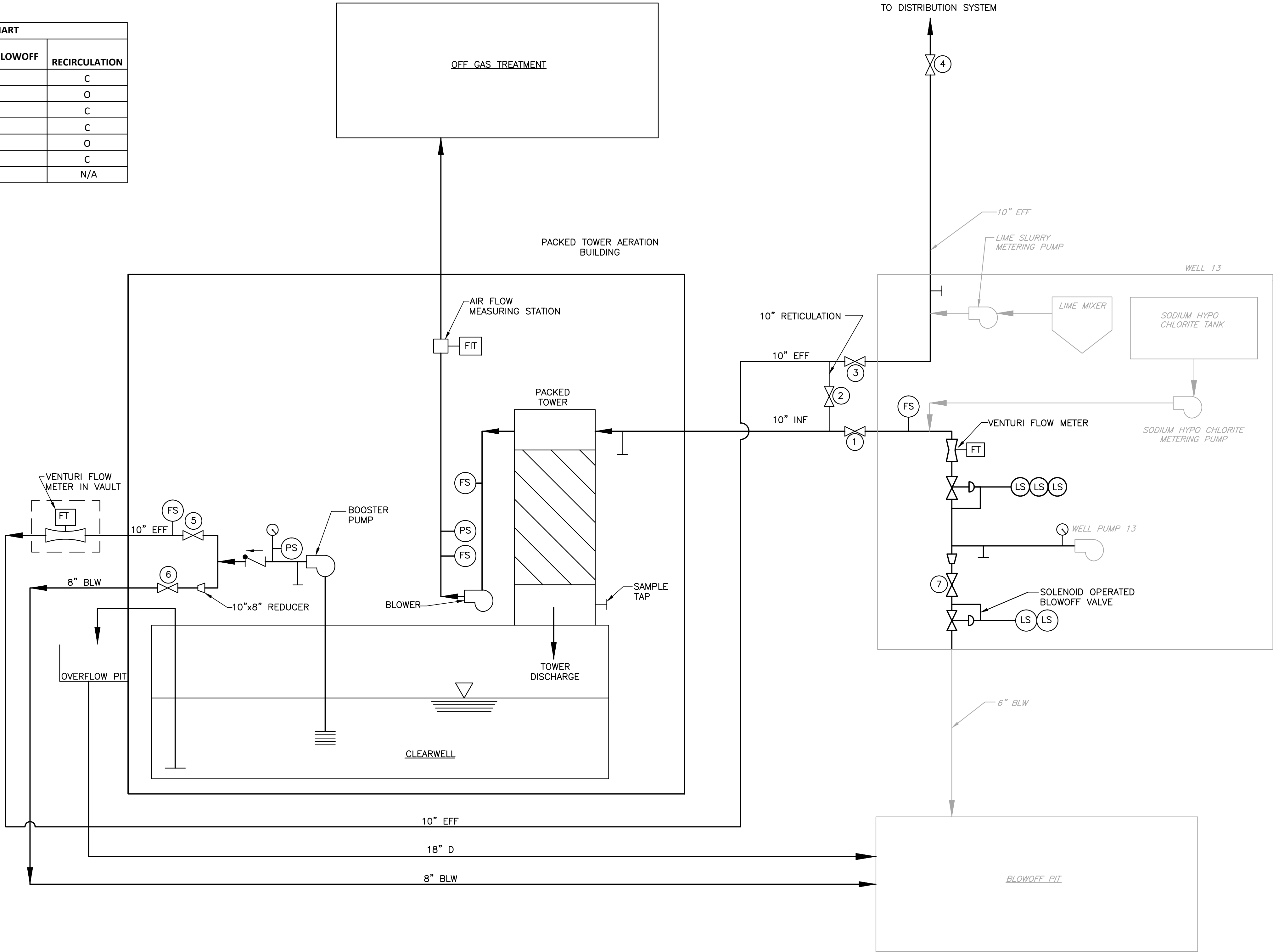
VALVE OPERATION CHART				
VALVE NUMBER	NORMAL OPERATION	OPERATE TO WASTE	WELL BLOWOFF	RECIRCULATION
1	O	O	C	C
2	C	C	N/A	O
3	O	N/A	N/A	C
4	O	N/A	N/A	C
5	O	C	N/A	O
6	C	O	N/A	C
7	O	O	O	N/A

LEGEND

O = OPEN

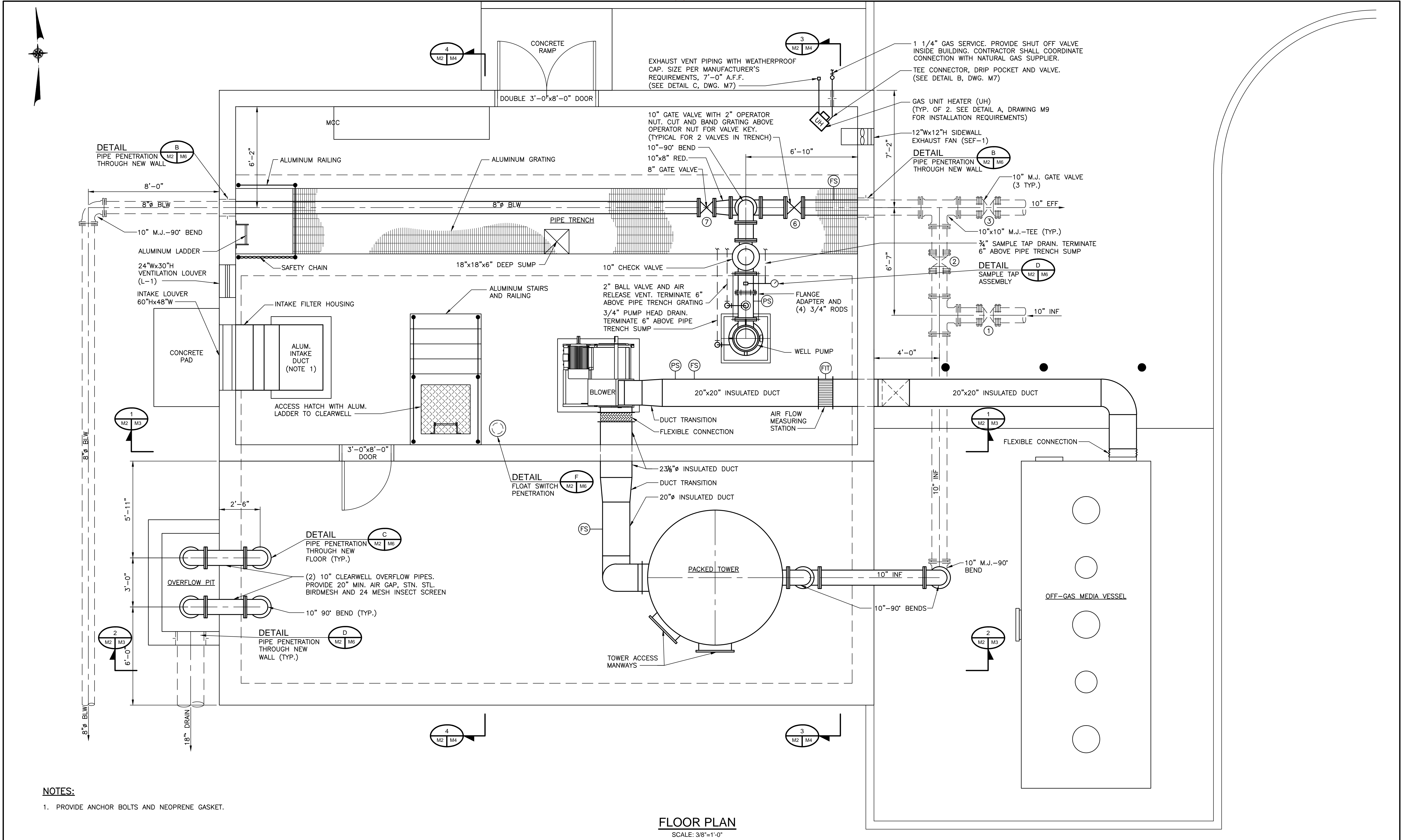
C = CLOSED

N/A = NOT APPLICABLE



LEGEND

- BLW BLOWOFF
- D GRAVITY DRAIN
- DIS BOOSTER PUMP DISCHARGE
- INF PACKED TOWER INFLUENT
- REC RECIRCULATION
- SS SAMPLING SERVICE
- FS FLOW SWITCH
- FT FLOW TRANSMITTER
- LS LIMIT SWITCH
- PS PRESSURE SWITCH
- PG PRESSURE GAUGE
- PT PRESSURE TRANSMITTER
- CV CHECK VALVE
- GV GATE VALVE
- BP BOOSTER PUMP/BLOWER
- MV MOTORIZED BUTTERFLY VALVE
- HCV HYDRAULIC CONTROL VALVE
- I SAMPLE TAP
- EXISTING
- PROPOSED

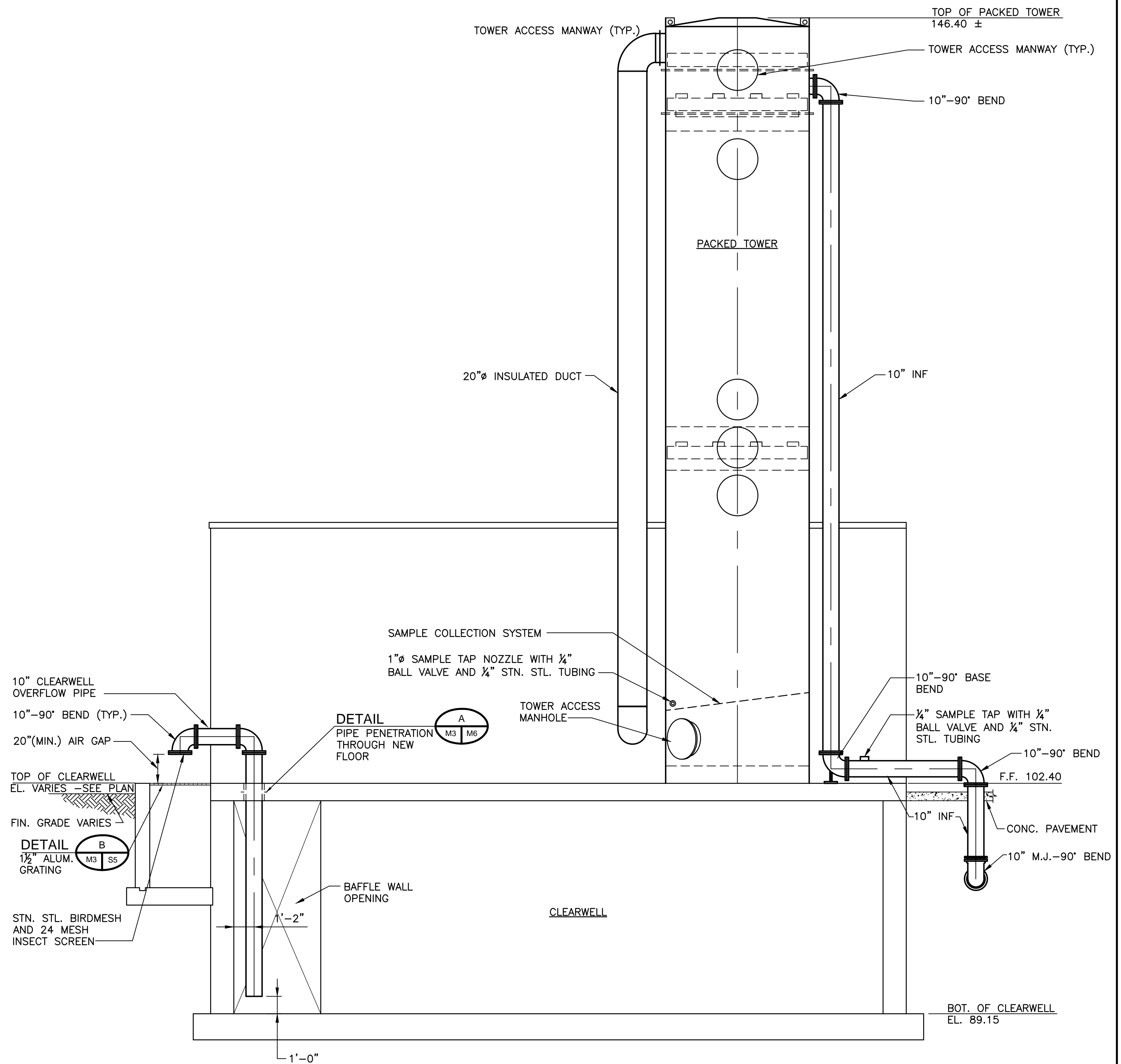
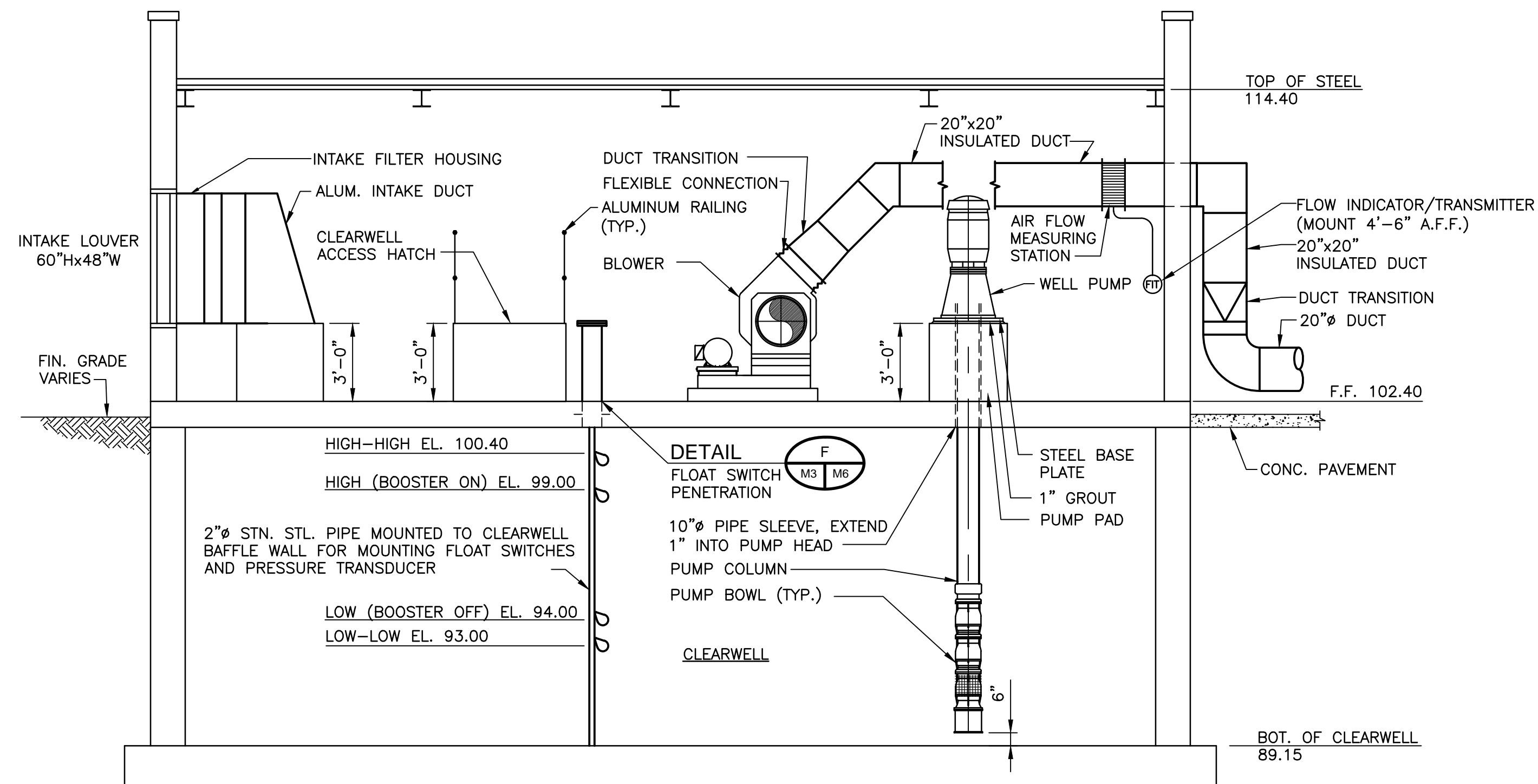


NOTES:

1. PROVIDE ANCHOR BOLTS AND NEOPRENE GASKET.

FLOOR PLAN
SCALE: 3/8"=1'-0"

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NO.	DATE	REVISION	INT.



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WDM/SL		WDM	



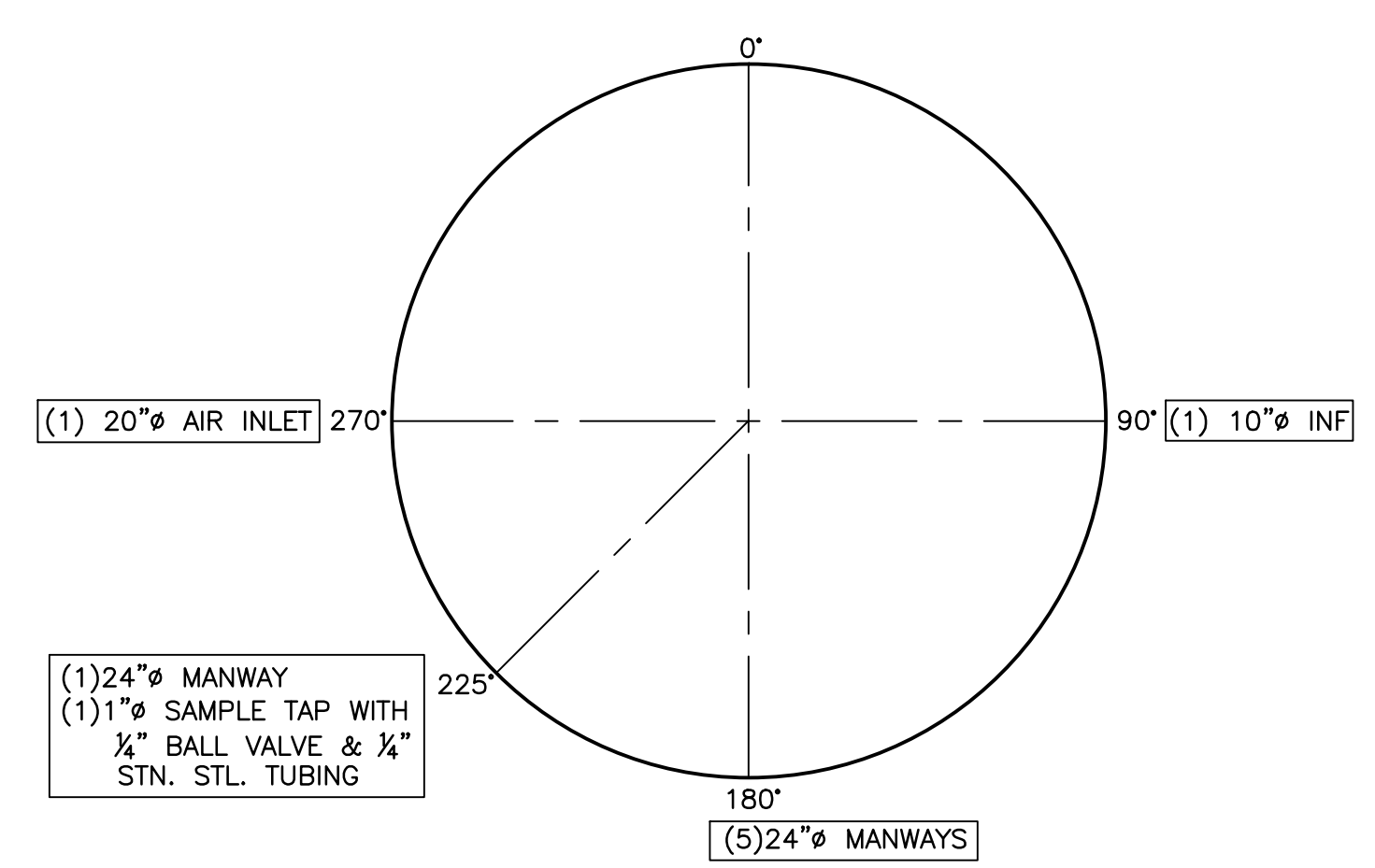
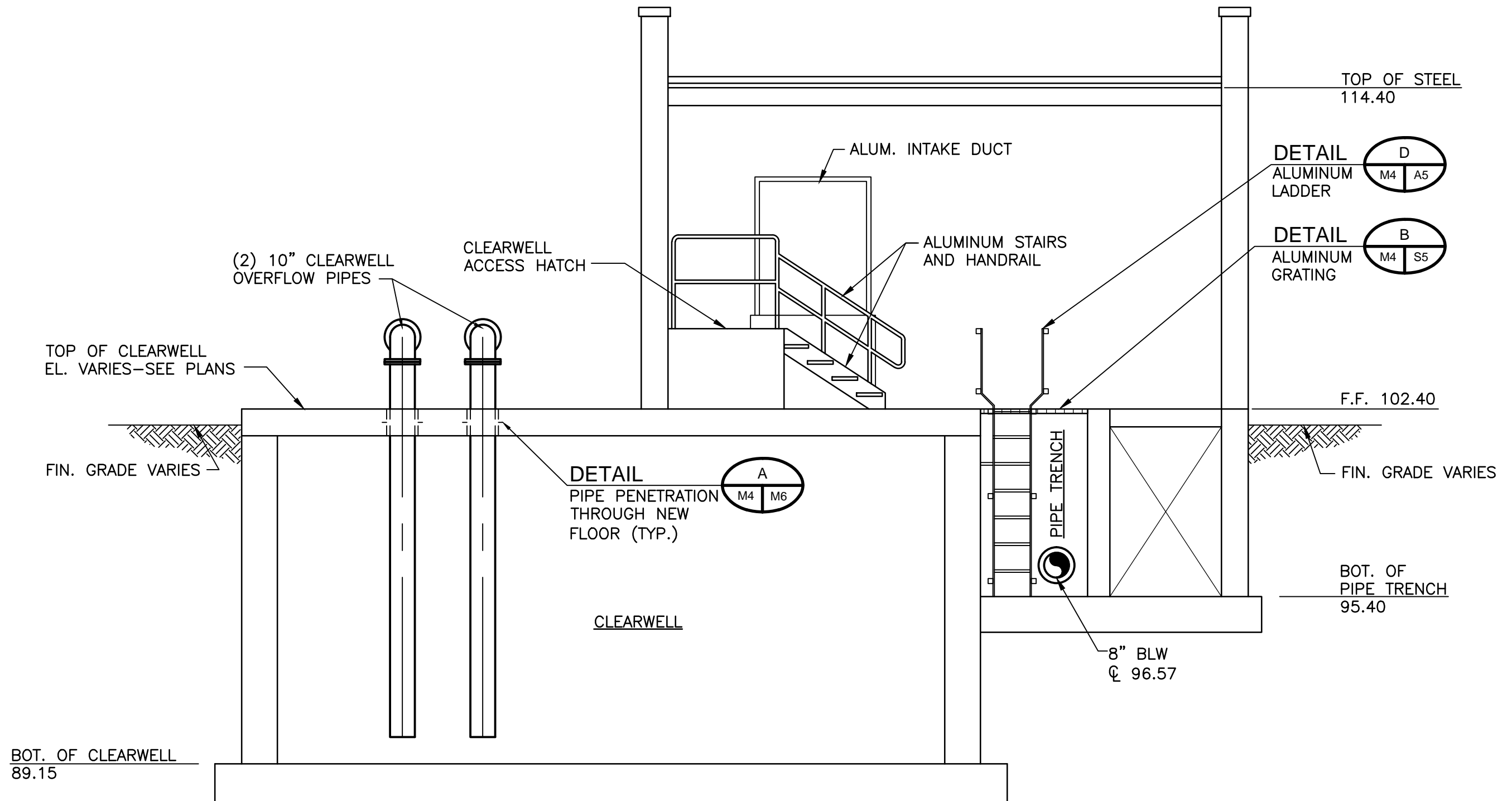
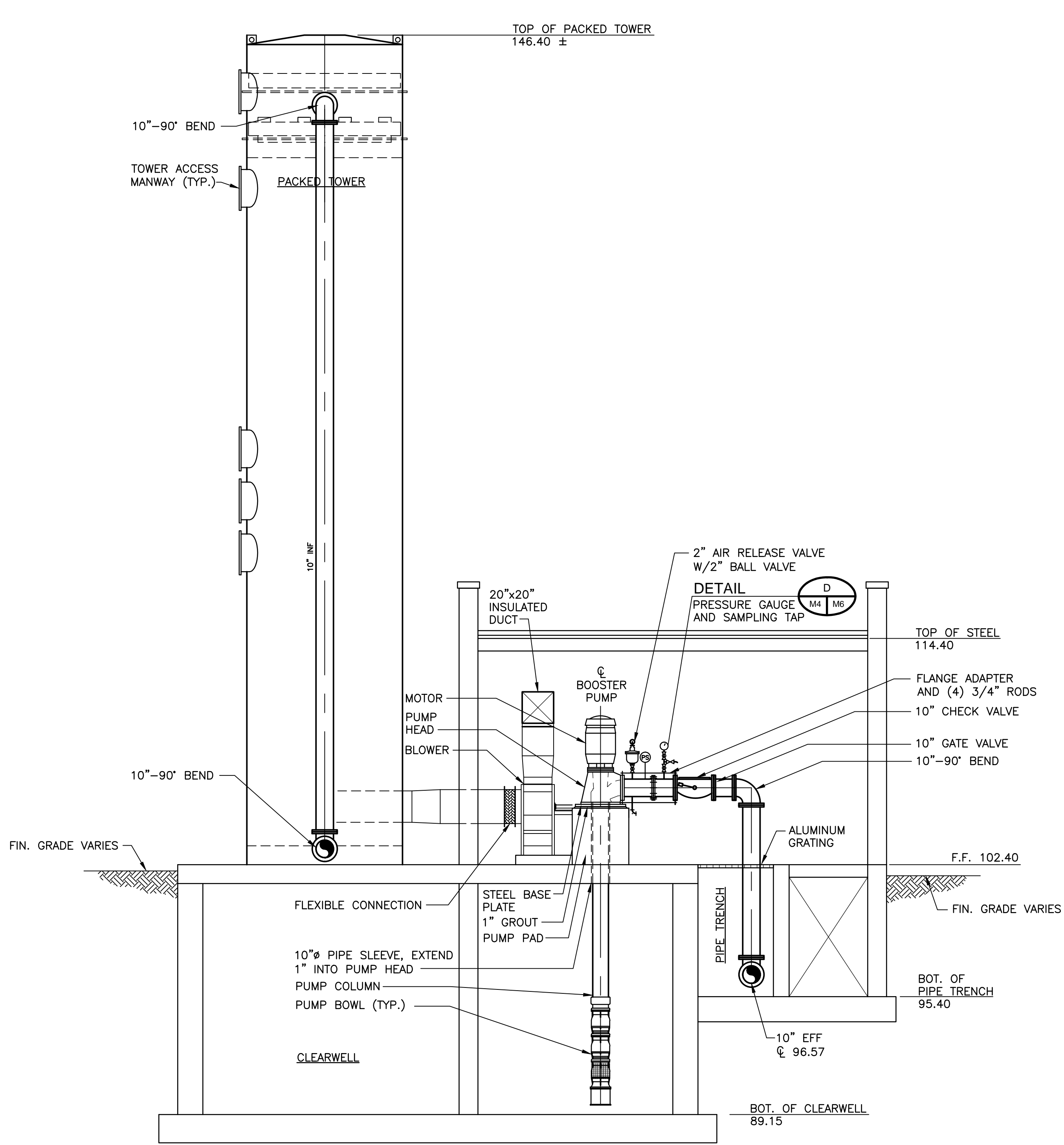
**D&B ENGINEERS
AND
ARCHITECTS, P.C.**

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

**PACKED TOWER BUILDING
SECTIONS 1 & 2
MECHANICAL**

PROJECT NO. 3402	M3
DATE: NOVEMBER 2014	
SCALE: 1/4"=1'-0"	



NO.	DATE	REVISION	INT.



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SL		JEZ	
DESIGNED BY:		CHECKED BY:	
WDM/SL		WDM	

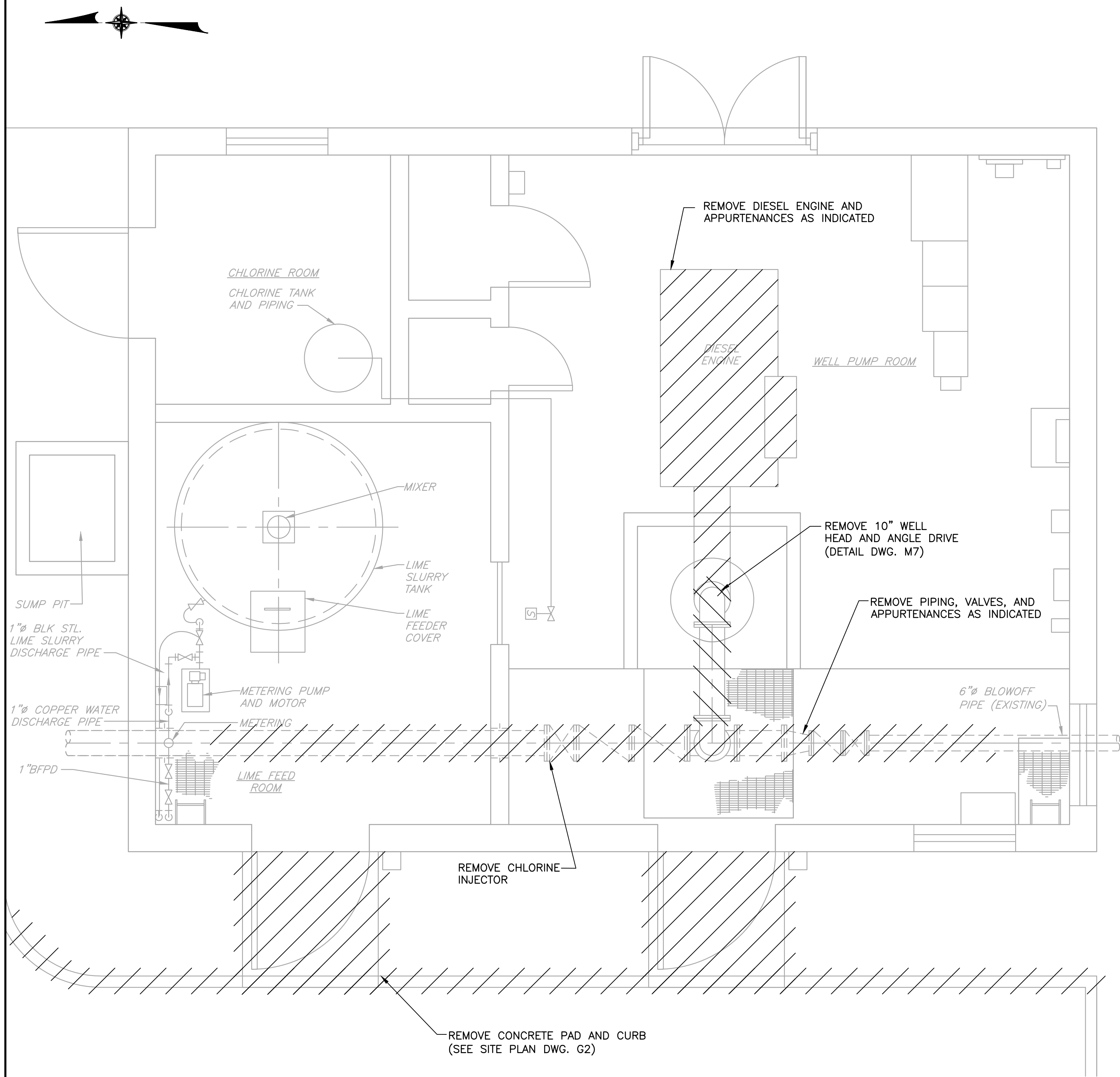
db **D&B ENGINEERS AND ARCHITECTS, P.C.**
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
NASSAU COUNTY NEW YORK
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13

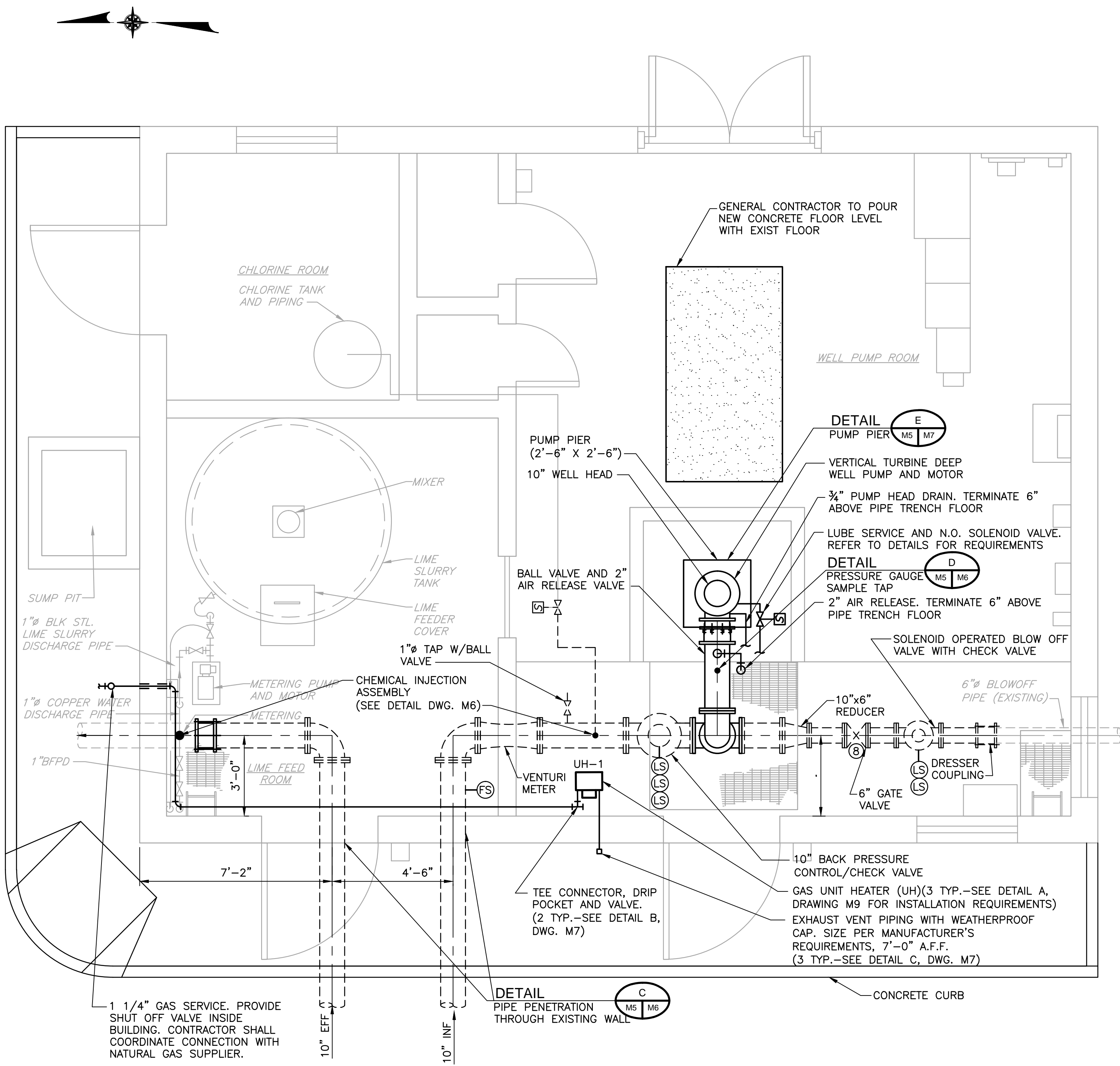
PACKED TOWER BUILDING
SECTIONS 3 & 4
MECHANICAL

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: 1/4"=1'-0"

DRAWING NO.
M4



EXISTING WELL 13 FLOOR PLAN
SCALE: 3/8"=1'-0"



PROPOSED WELL 13 FLOOR PLAN
SCALE: 3/8"=1'-0"

NO.	DATE	REVISION	INT.	



UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			
PROJECT ENGINEER:		DRAWN BY:	
SL		JEZ	
DESIGNED BY:		CHECKED BY:	
WDM/SL		WDM	



**D&B ENGINEERS
AND
ARCHITECTS, P.C.**

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NASSAU COUNTYNEW YORK

**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**

LEVITTOWN WATER DISTRICT

**CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

WELL 13 BUILDING

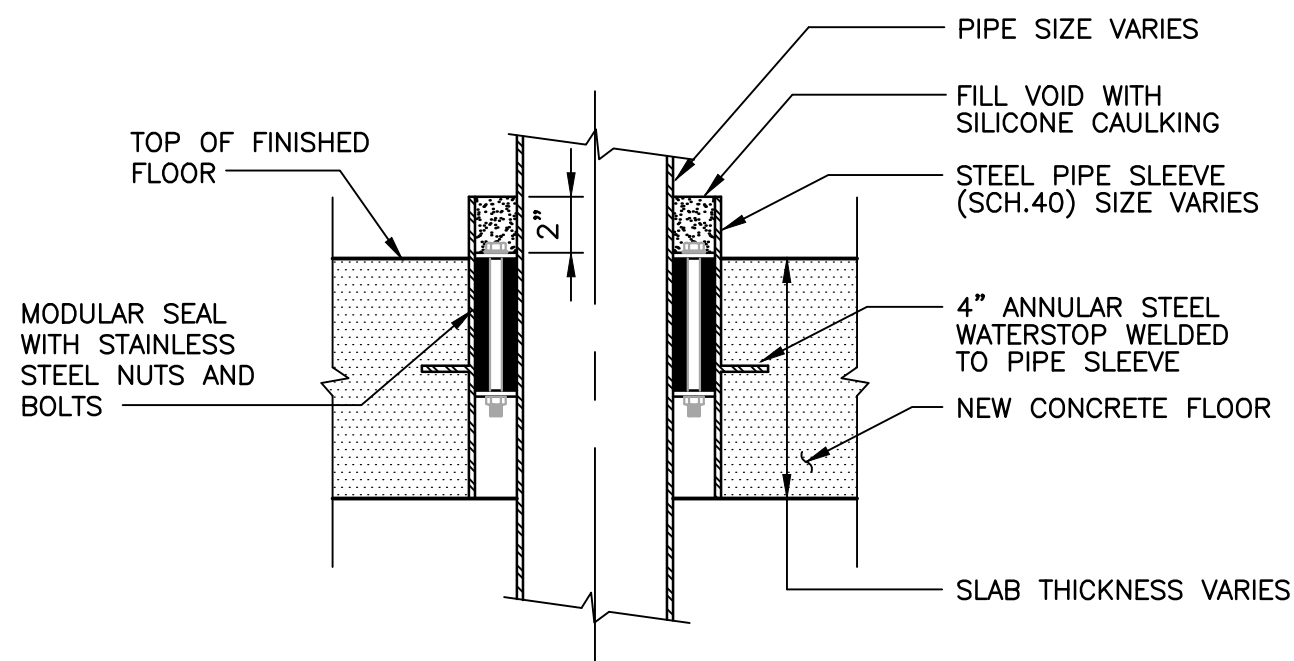
EXISTING AND PROPOSED FLOOR PLANS

MECHANICAL

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: 3/8"=1'-0"

DRAWING NO.

M5



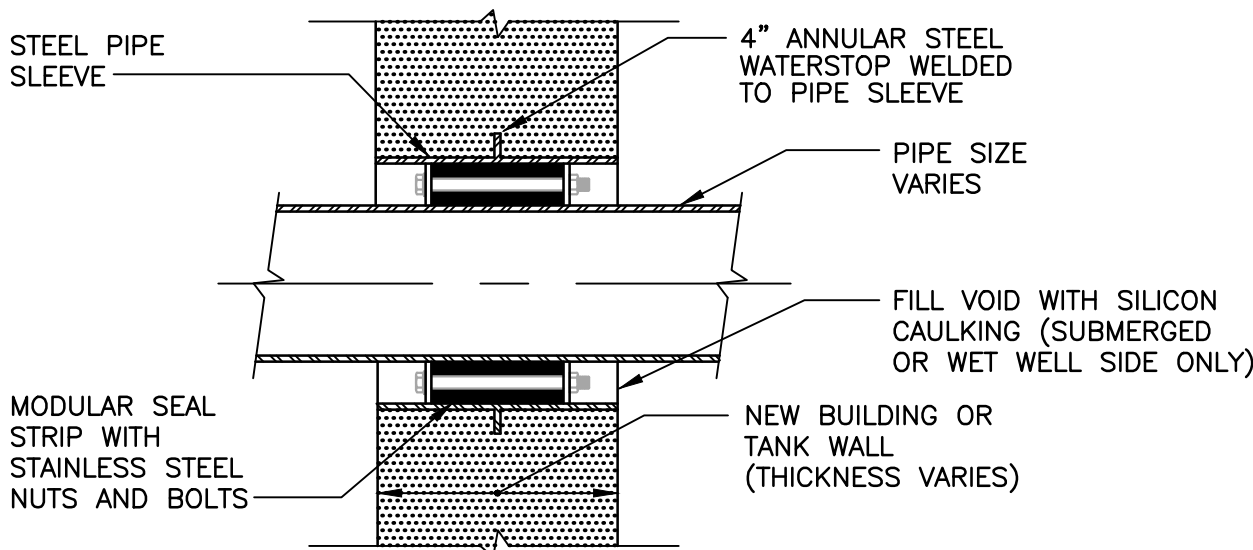
- NOTES:
1. MODULAR SEAL STRIP SHALL BE PLACED SO THAT BOLTS CAN BE ADJUSTED DURING NORMAL OPERATION.
 2. FLOORS 12" OR LARGER IN THICKNESS SHALL REQUIRE 2 MODULAR SEAL STRIPS.

TYPICAL PIPE PENETRATION THRU NEW FLOOR

N.T.S.



(USE FOR ALL NEW FLOOR PENETRATIONS)



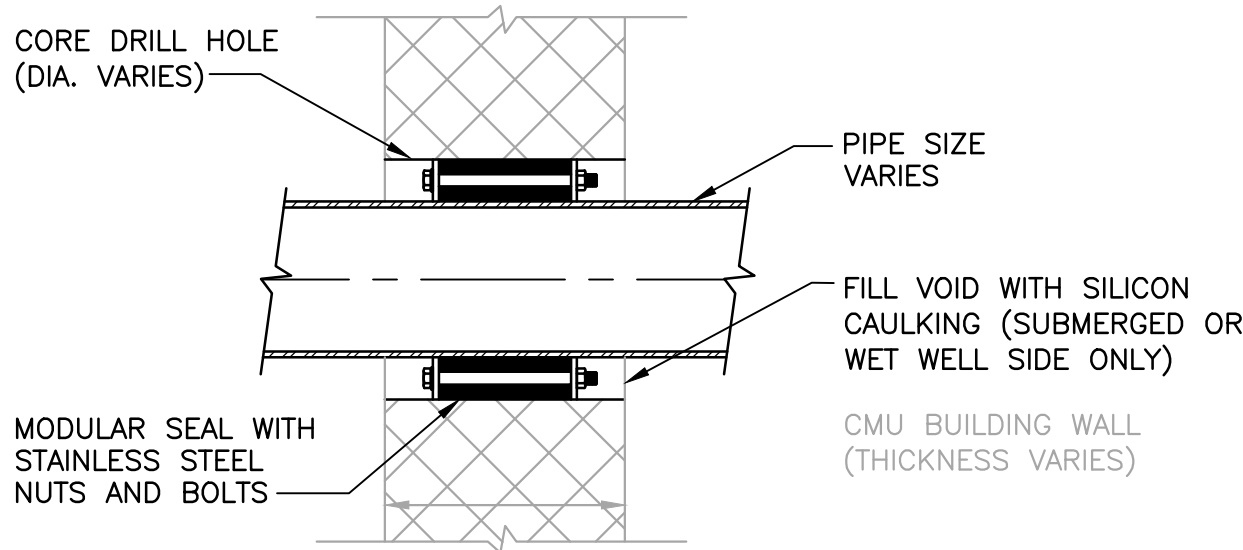
- NOTES:
1. MODULAR SEAL STRIP SHALL BE PLACED SO THAT BOLTS CAN BE ADJUSTED DURING NORMAL OPERATION.
 2. WALLS 12" OR LARGER IN THICKNESS SHALL REQUIRE 2 MODULAR SEAL STRIPS.

TYPICAL PIPE PENETRATION THRU NEW WALL

N.T.S.



(USE FOR ALL NEW WALL PENETRATIONS)

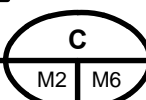


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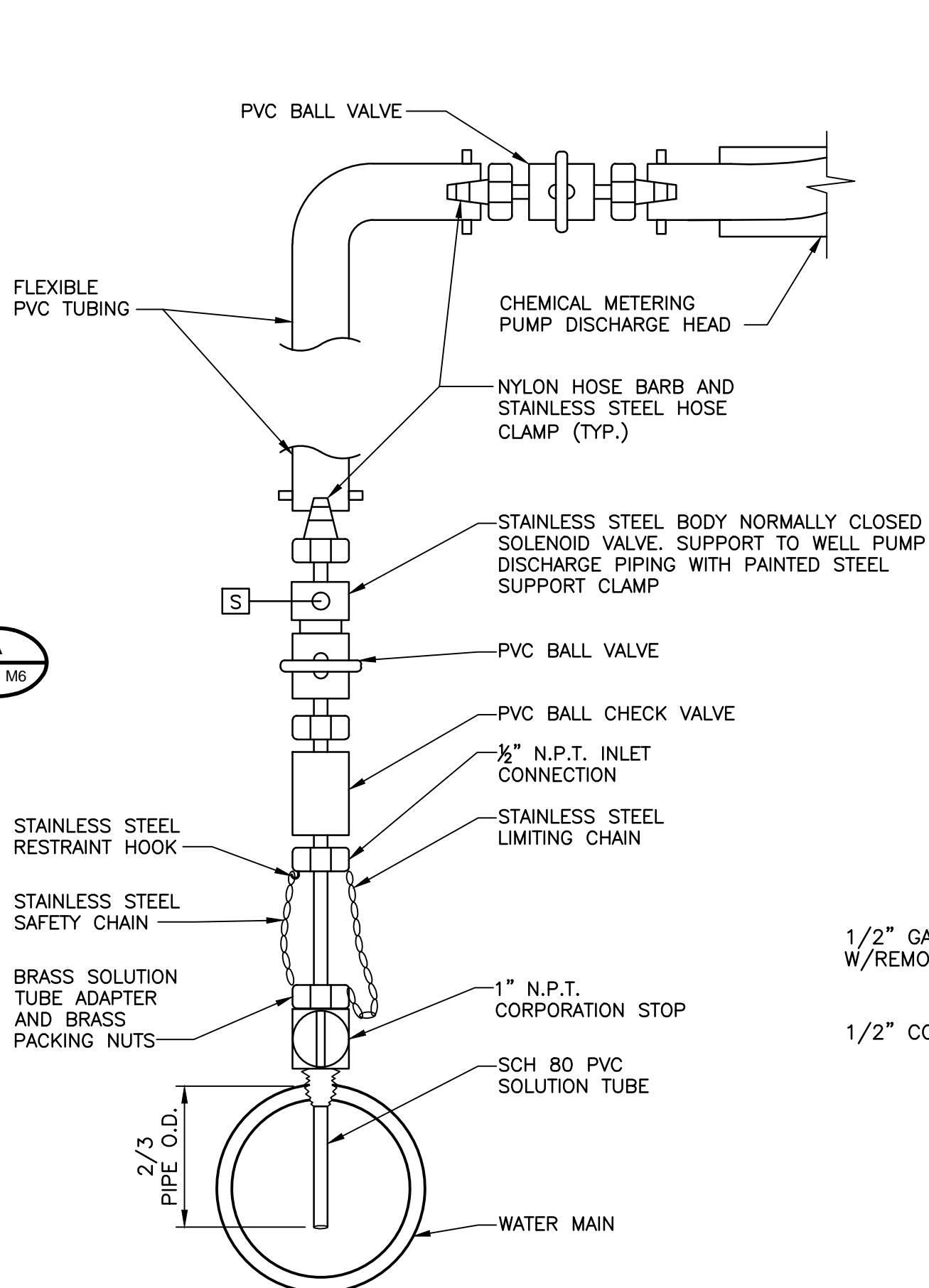
1. MODULAR SEAL STRIP SHALL BE PLACED SO THAT BOLTS CAN BE ADJUSTED DURING NORMAL OPERATION.
2. WALLS 12" OR LARGER IN THICKNESS SHALL REQUIRE 2 MODULAR SEAL STRIPS.

TYPICAL PIPE PENETRATION THRU EXISTING CMU WALL

N.T.S.

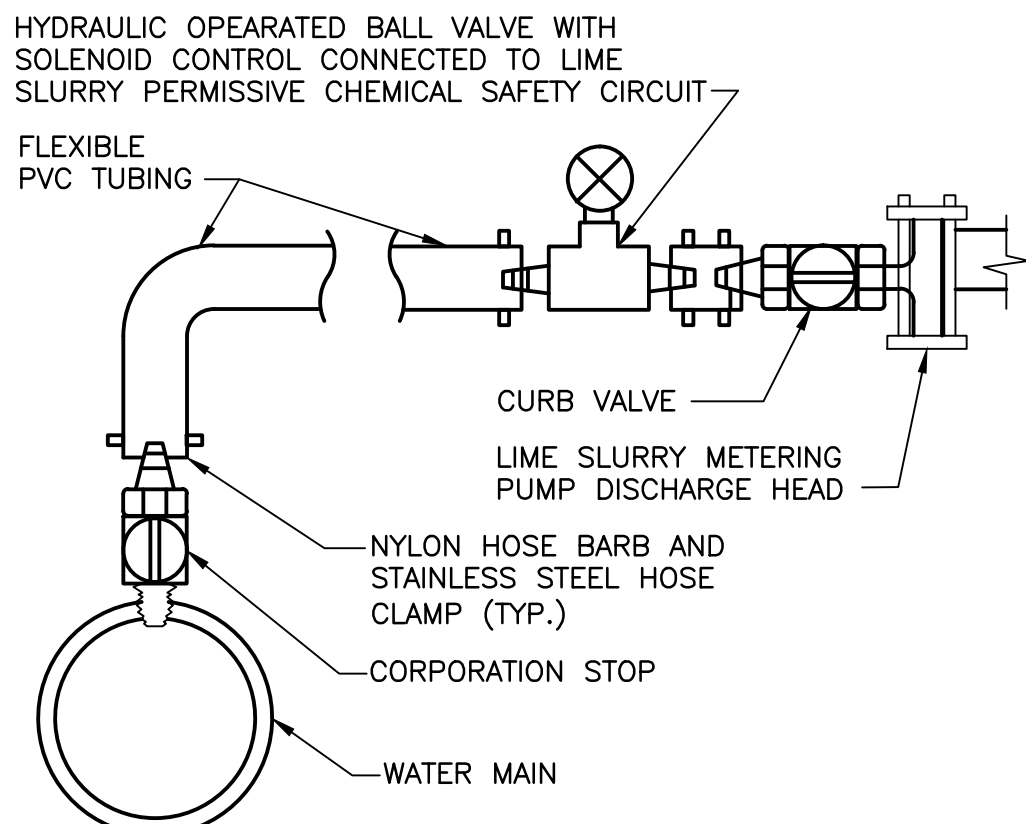


(USE FOR ALL EXISTING CMU WALL PENETRATIONS)



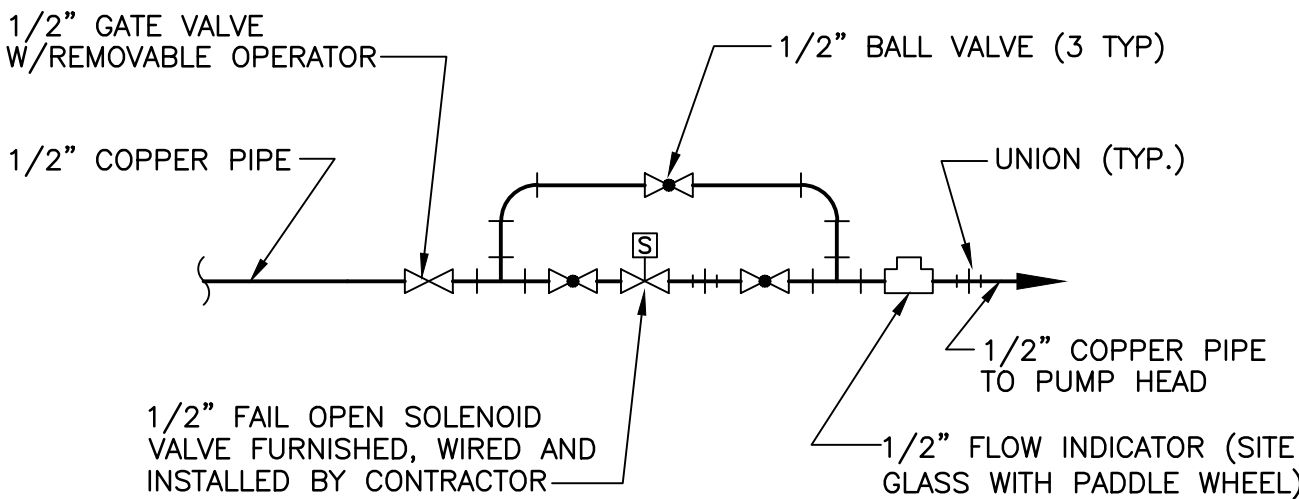
CHEMICAL SYSTEM TYPICAL INJECTION DETAIL

N.T.S.



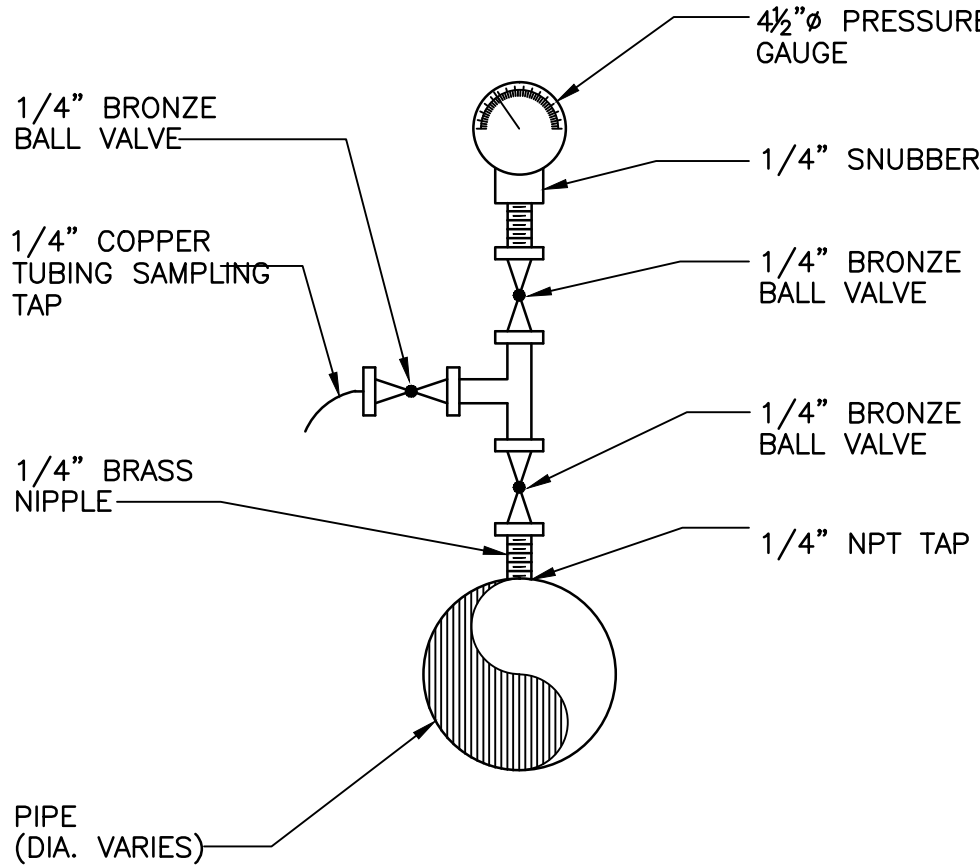
LIME SLURRY SYSTEM TYPICAL INJECTOR DETAIL

N.T.S.



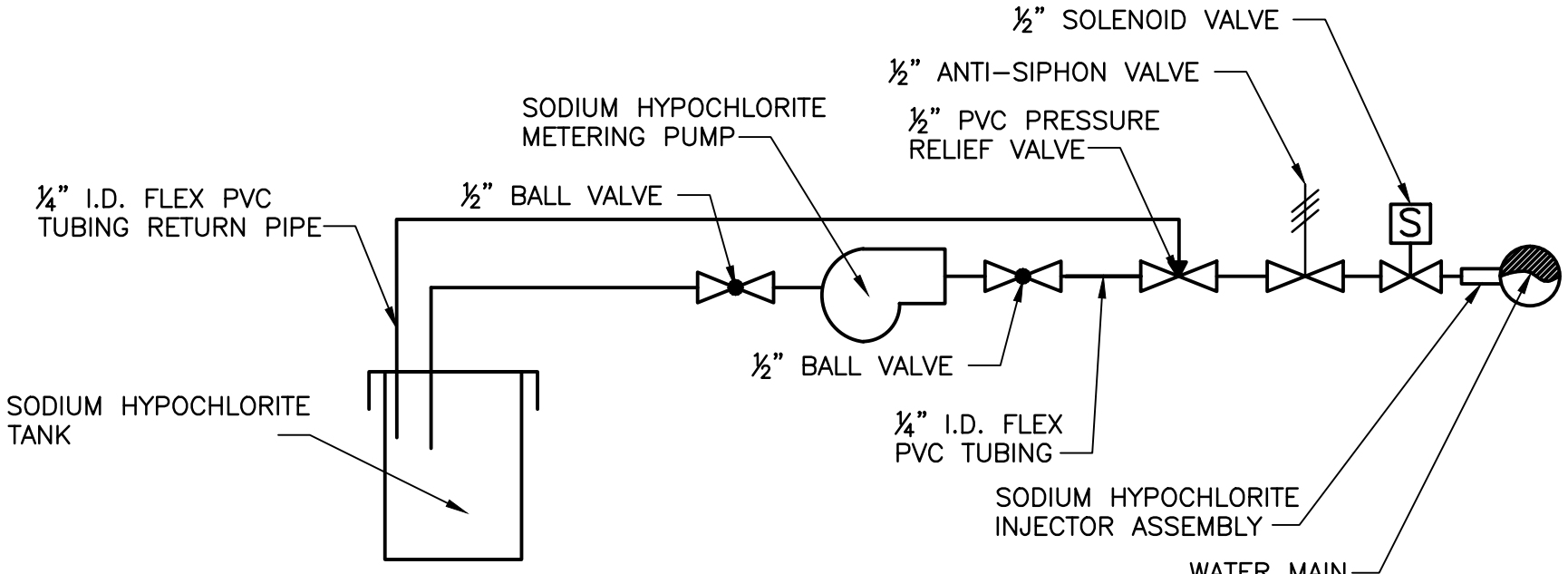
LUBE WATER ASSEMBLY DETAIL

N.T.S.



TYPICAL PRESSURE GAUGE SAMPLE TAP ASSEMBLY DETAIL

N.T.S.

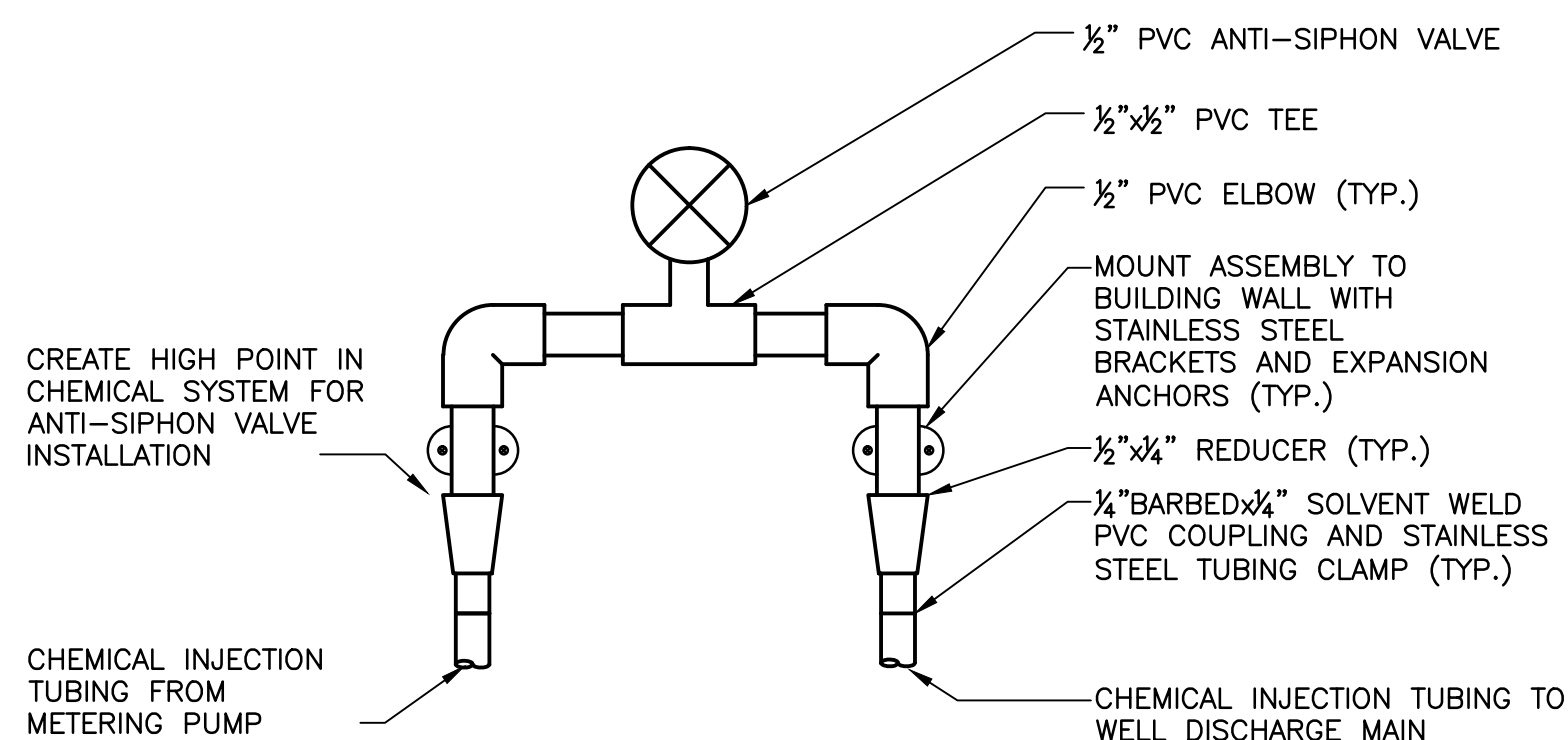


SODIUM HYPOCHLORITE PIPING SCHEMATIC

N.T.S.

NOTES:

1. ALL SODIUM HYPOCHLORITE PIPING SHALL BE LABELED WITH YELLOW TAPE IN ACCORDANCE WITH SPECIFICATIONS. "SODIUM HYPOCHLORITE" AND ARROW INDICATING DIRECTION OF FLOW SHALL BE LABELED EACH 10 FEET OF PIPING.
2. INSTALL ANTI-SIPHON VALVE AT HIGH POINT IN SYSTEM AND IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS



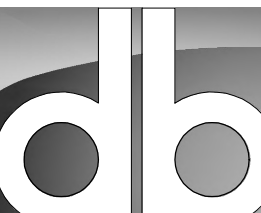
CHEMICAL PIPING ANTI-SIPHON ASSEMBLY

N.T.S.

NO.	DATE	REVISION	INT.



UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			
PROJECT ENGINEER:	SL	DRAWN BY:	JEZ
DESIGNED BY:	WDM/SL	CHECKED BY:	WDM



**D&B ENGINEERS
AND
ARCHITECTS, P.C.**
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**

NASSAU COUNTY

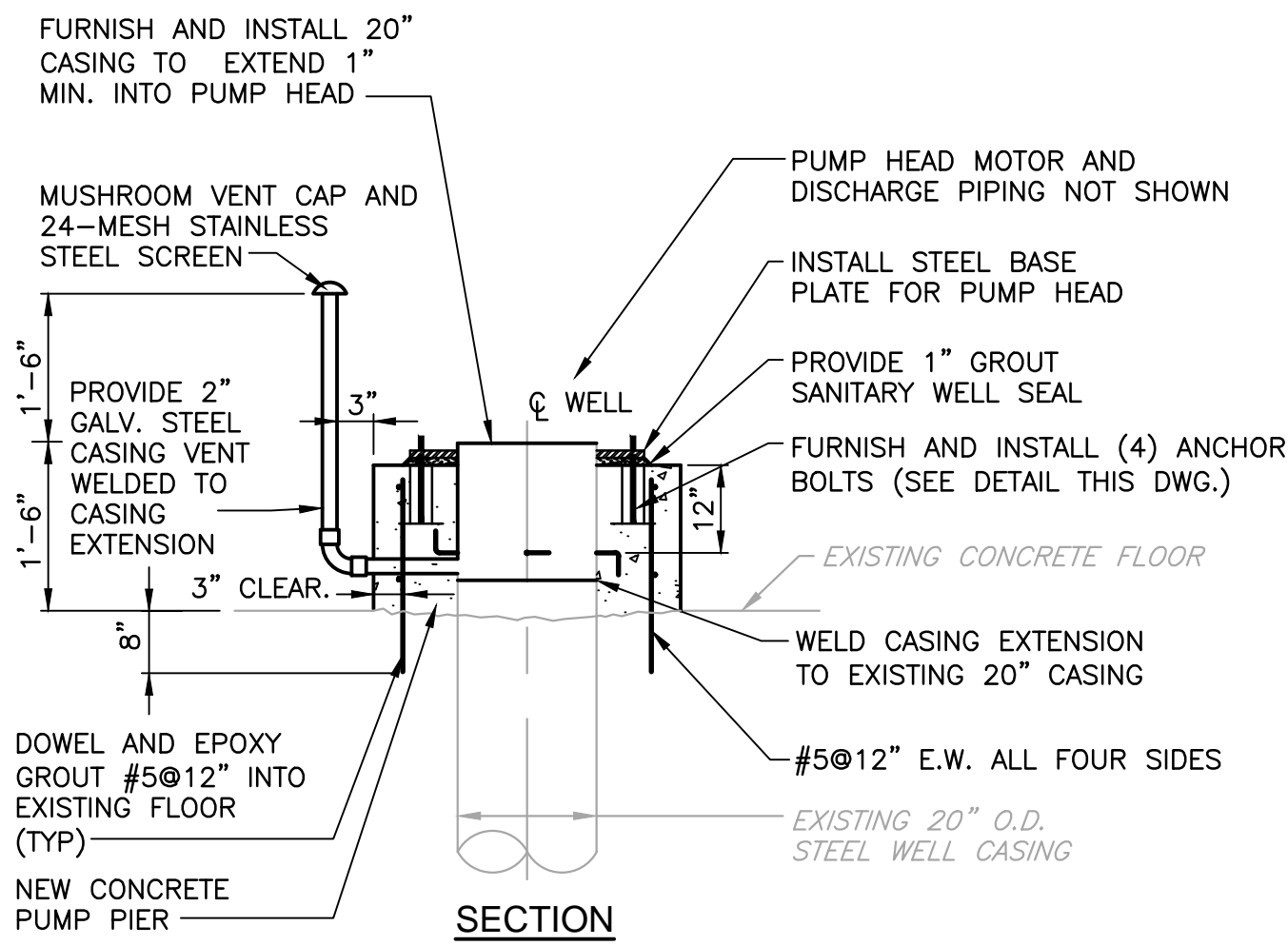
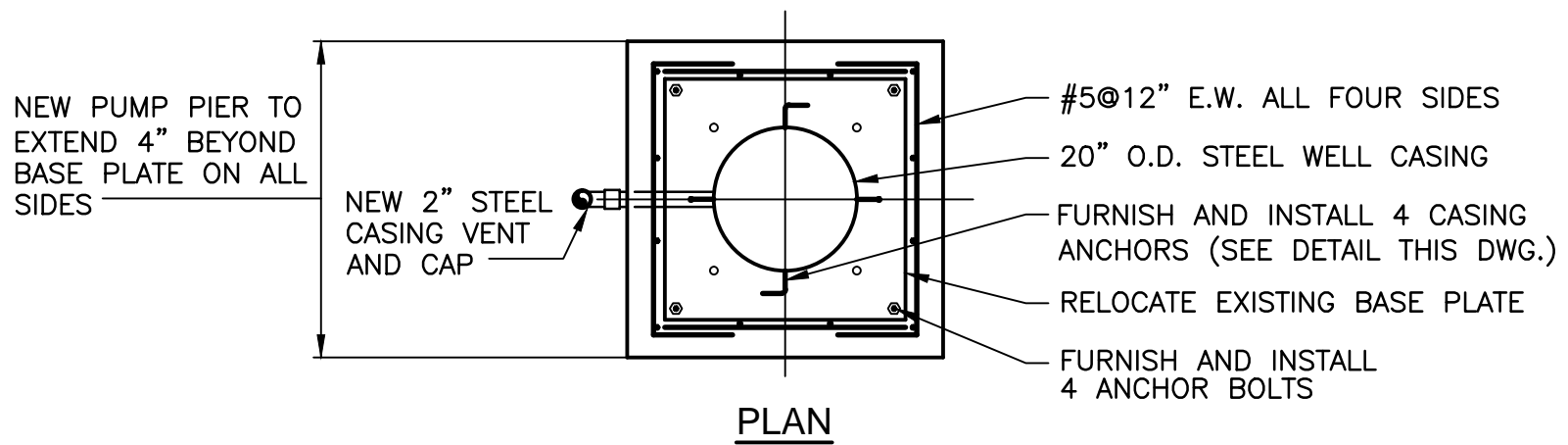
NEW YORK

**LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

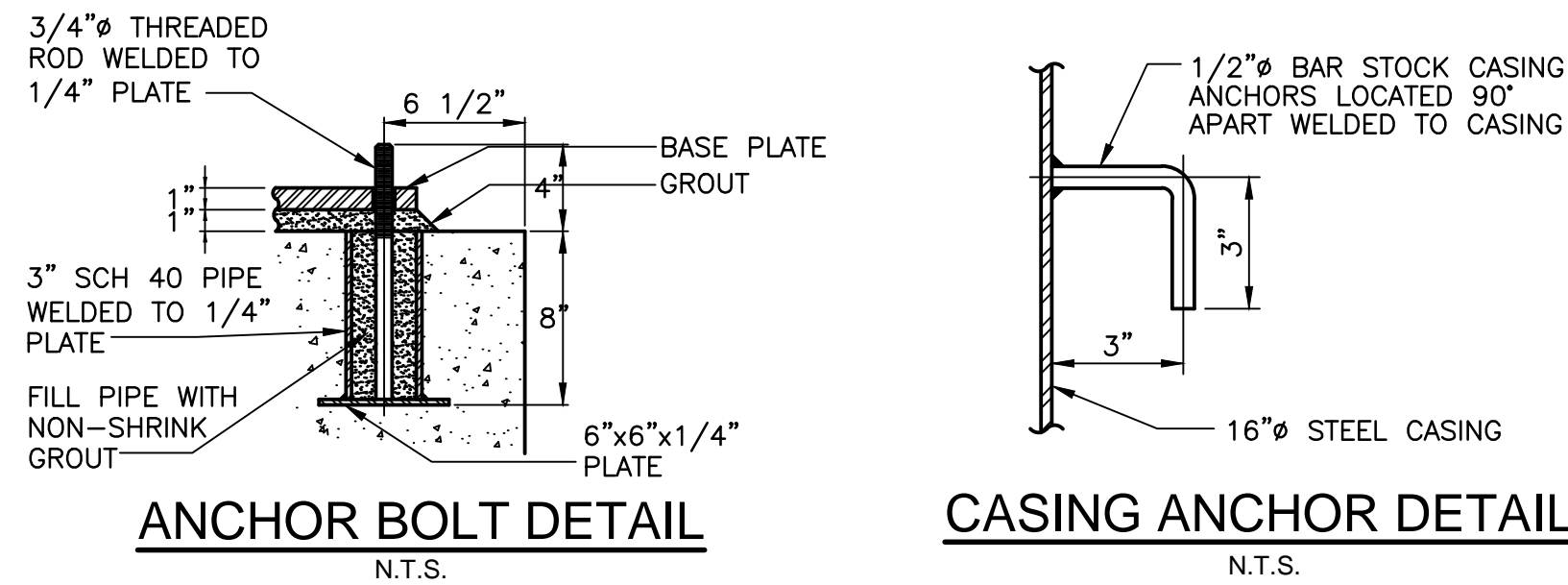
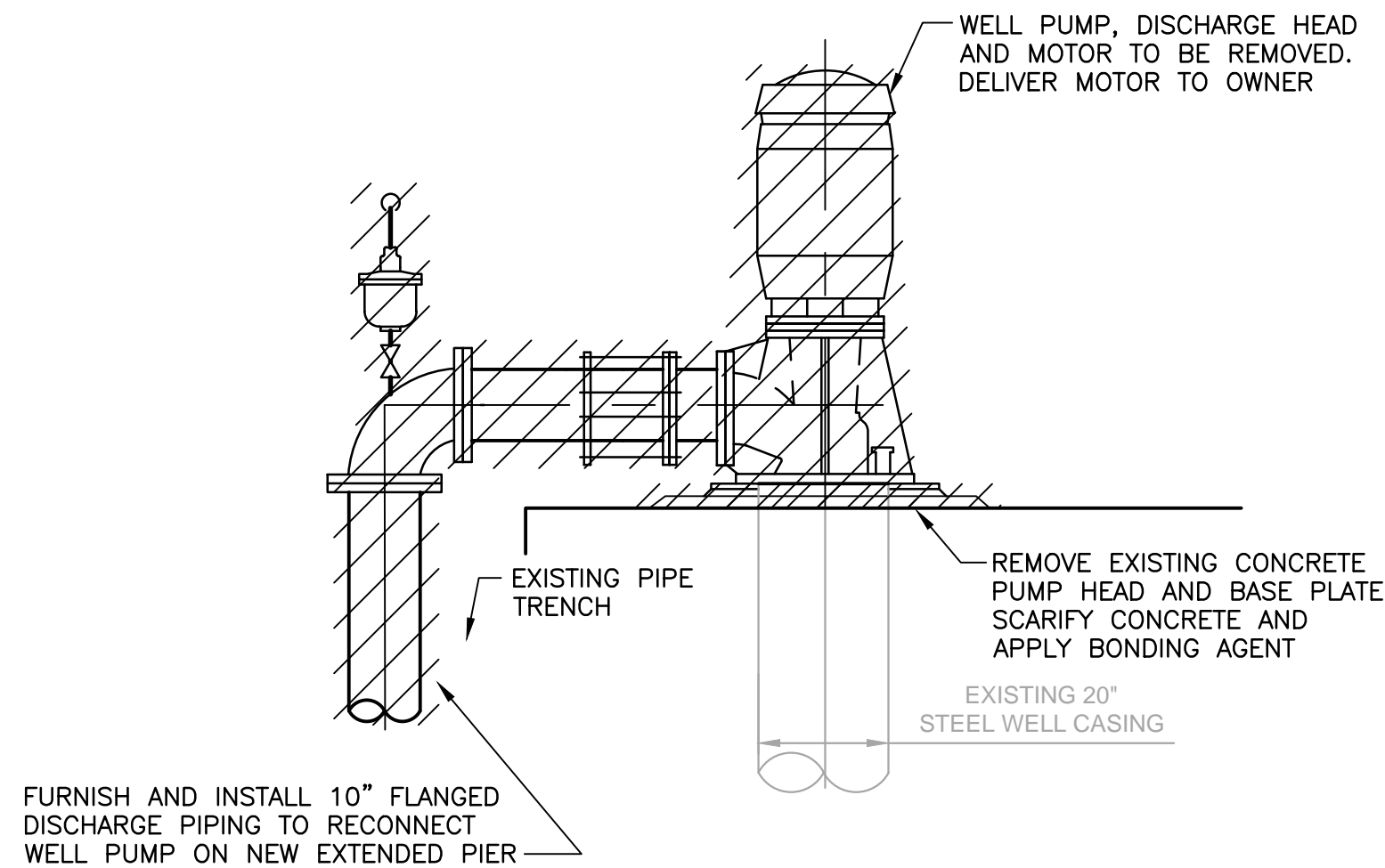
**PACKED TOWER BUILDING
DETAILS I**

MECHANICAL

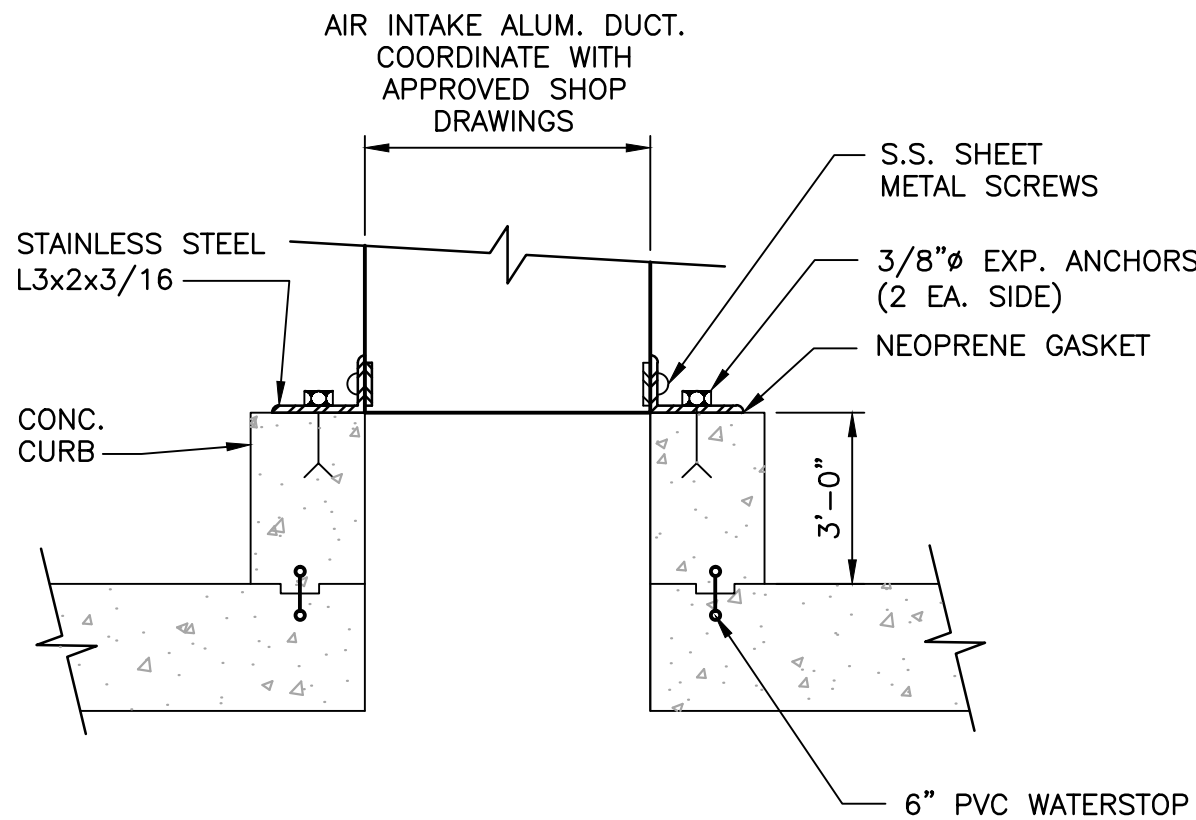
PROJECT NO. 3402	M6
DATE: NOVEMBER 2014	
SCALE: AS NOTED	



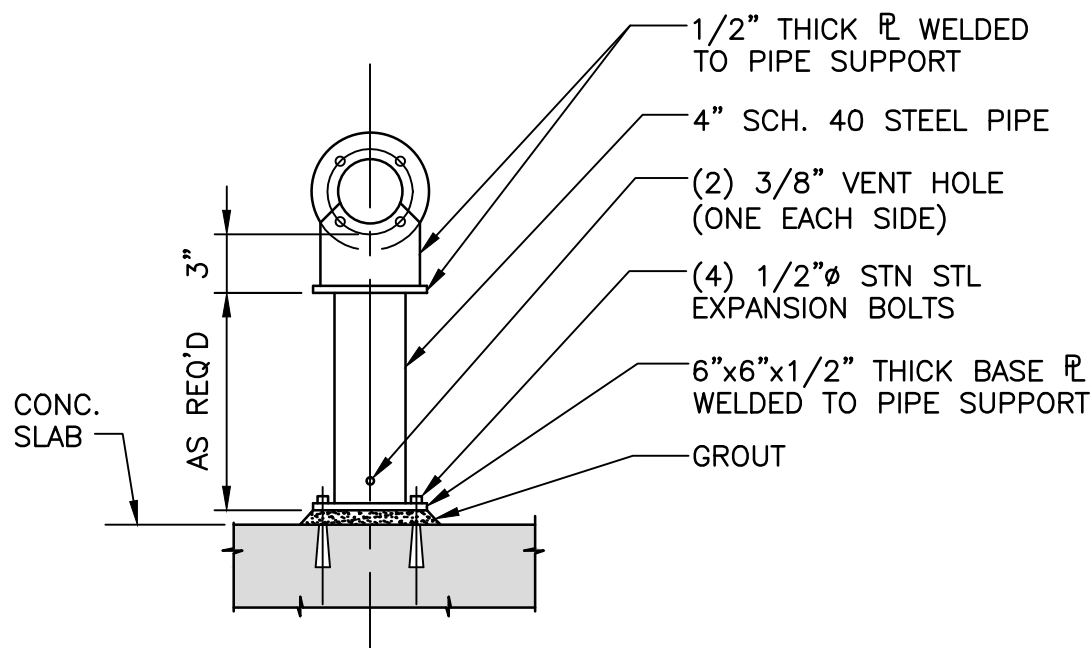
PUMP PIER DETAIL
N.T.S.



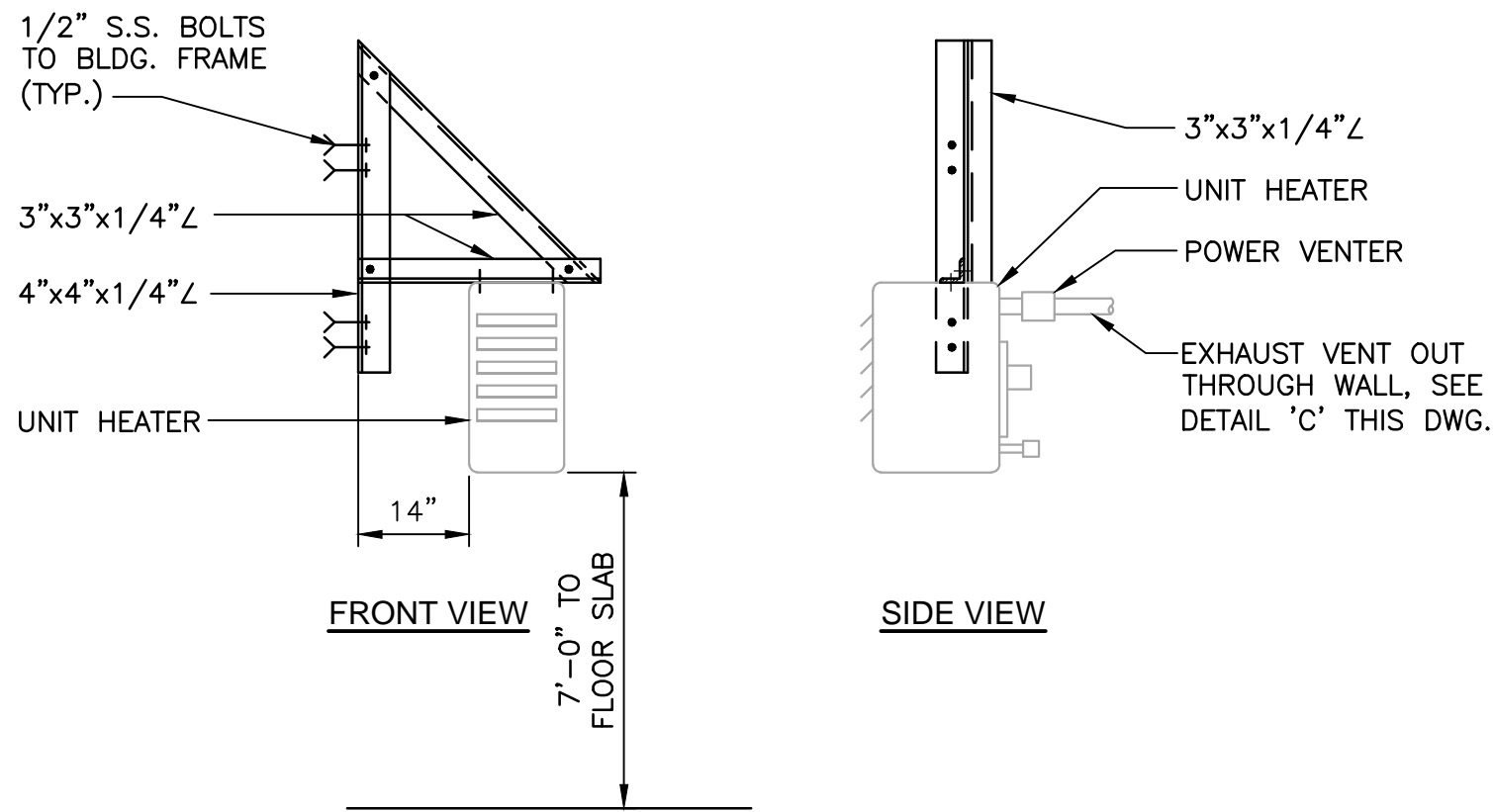
CASING ANCHOR DETAIL
N.T.S.



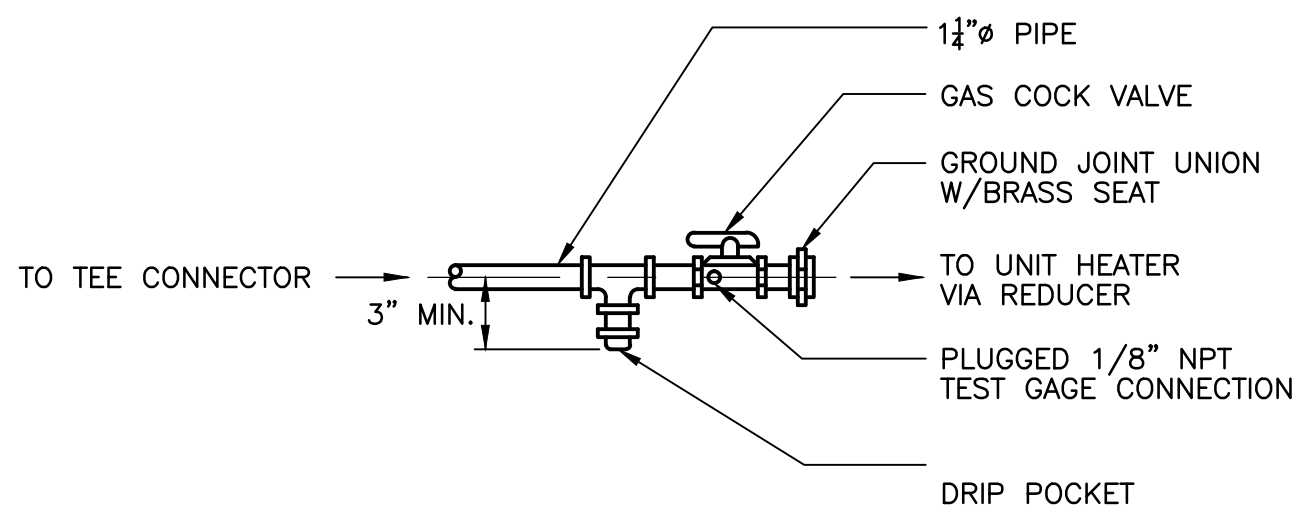
DUCT MOUNTING DETAIL
N.T.S.



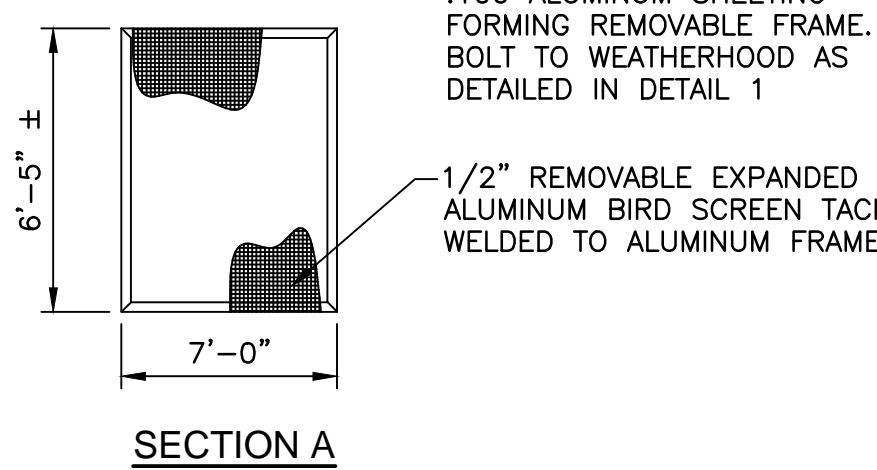
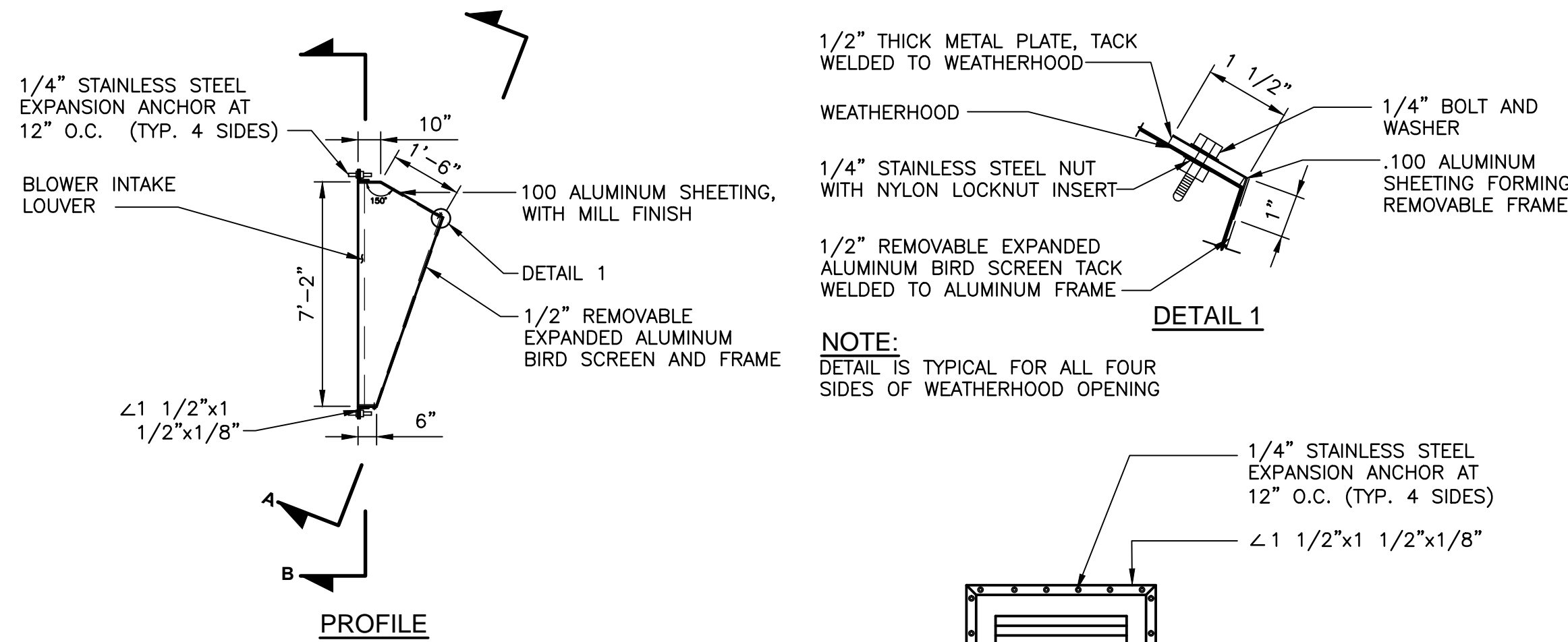
PIPE SUPPORT DETAIL
N.T.S.



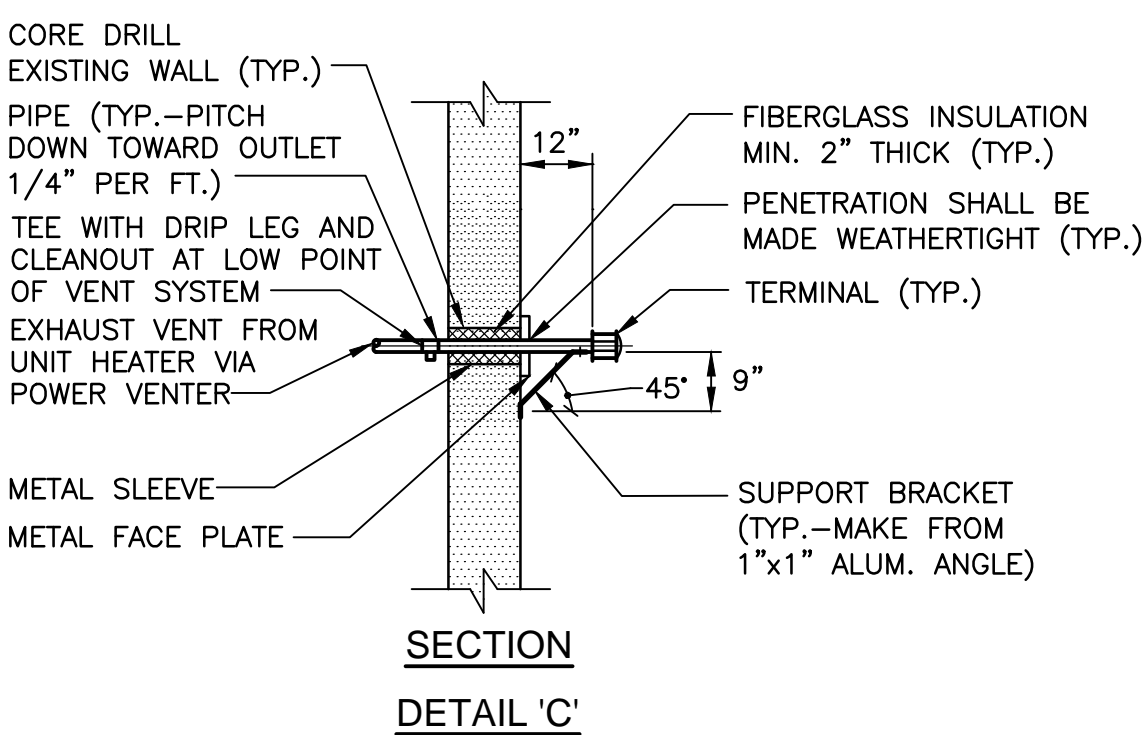
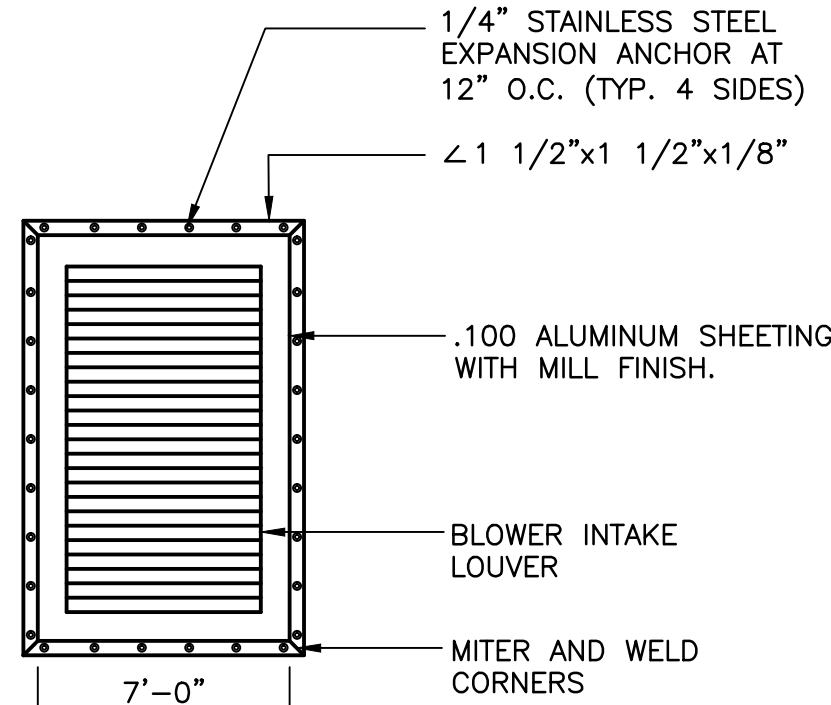
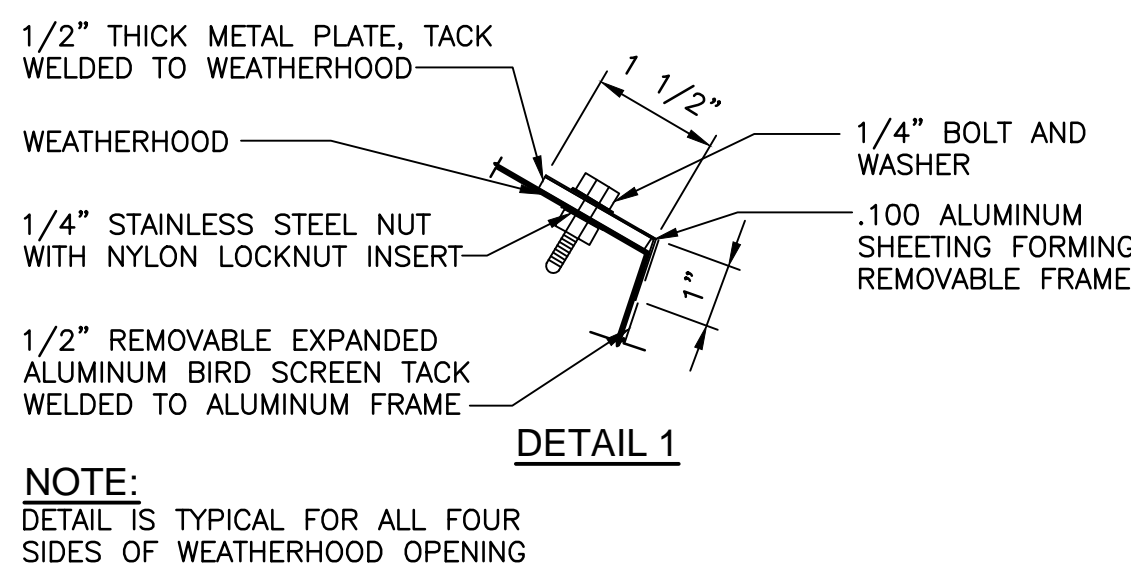
DETAIL 'A'



GAS UNIT HEATER DETAILS
N.T.S.



LOUVER WEATHER HOOD DETAIL
N.T.S.



- NOTES:**
1. REFER TO DWG. G1 FOR SYMBOLS AND ABBREVIATIONS.
 2. CONTRACTOR SHALL PAINT GAS PIPING AND SUPPORT BRACKETS.
 3. ALL INTERIOR GAS PIPING SHALL BE ASTM 53 BLACK STEEL WITH THREADED MALLEABLE IRON FITTING.

					UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			TOWN OF HEMPSTEAD DEPARTMENT OF WATER		PACKED TOWER BUILDING DETAILS II MECHANICAL	PROJECT NO. 3402		M7				
					PROJECT ENGINEER: SL			DESIGNED BY: WDM/SL			DATE: NOVEMBER 2014						
					DRAWN BY: JEZ			CHECKED BY: WDM			SCALE: AS NOTED						
					NO.			DATE			REVISION						
											</						

WANTAGH AVENUE

ENTRY LANE

ELM DRIVE

NOTES:

1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
2. COORDINATE THE REMOVAL OF THE INCOMING ELECTRICAL SERVICE (PRIMARY AND SECONDARY) WITH THE OWNER AND WITH PSEG. REFER TO SPECIFICATION SECTION 16101.
3. REFER TO SPECIFICATION SECTION 01010 FOR SEQUENCE OF CONSTRUCTION AND MAINTENANCE OF OPERATION REQUIREMENTS.
4. PULL BRUSH THROUGH EXISTING CONDUIT FROM RISER POLE TO PROPERTY LINE BOX TO CLEAN CONDUIT.

CONDUIT TO RISER POLE ON WEST SIDE OF WANTAGH AVENUE (125'± FROM RISER POLE TO PROPERTY LINE BOX)

DISCONNECT AND REMOVE PRIMARY CABLE IN 3" RGS CONDUIT FROM RISER POLE TO PROPERTY LINE BOX (NOTE 4)

DISCONNECT AND REMOVE PRIMARY CABLES FROM PROPERTY LINE BOX TO PSEG PADMOUNT TRANSFORMER. ABANDON CONDUIT IN PLACE. (NOTE 2)

DISCONNECT AND REMOVE 480V MOTOR CONTROL CENTER

ELECTRICAL DISTRIBUTION EQUIPMENT

REFER TO DRAWING E2 FOR WORK IN THE WELL 13 BUILDING

DISCONNECT AND REMOVE 480/277V SERVICE FROM PSEG PADMOUNT TRANSFORMER TO WELL 13 ELECTRICAL SERVICE EQUIPMENT. (NOTE 2)

DISCONNECT AND REMOVE PSEG PADMOUNT TRANSFORMER AND CONCRETE PAD. COORDINATE WORK WITH PSEG.

PSEG PADMOUNT TRANSFORMER

WELL BLDG

SUMP P

FUEL TANK

CONC. CURB

CONC. WALK

CONC. WALK

FENCE

CONC. CURB

CONC. WALK

FENCE

CURB CUT

CONC. APRON

GATE

FENCE

FENCE

ELECTRICAL PROPERTY LINE BOX MANHOLE

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

6"BLW

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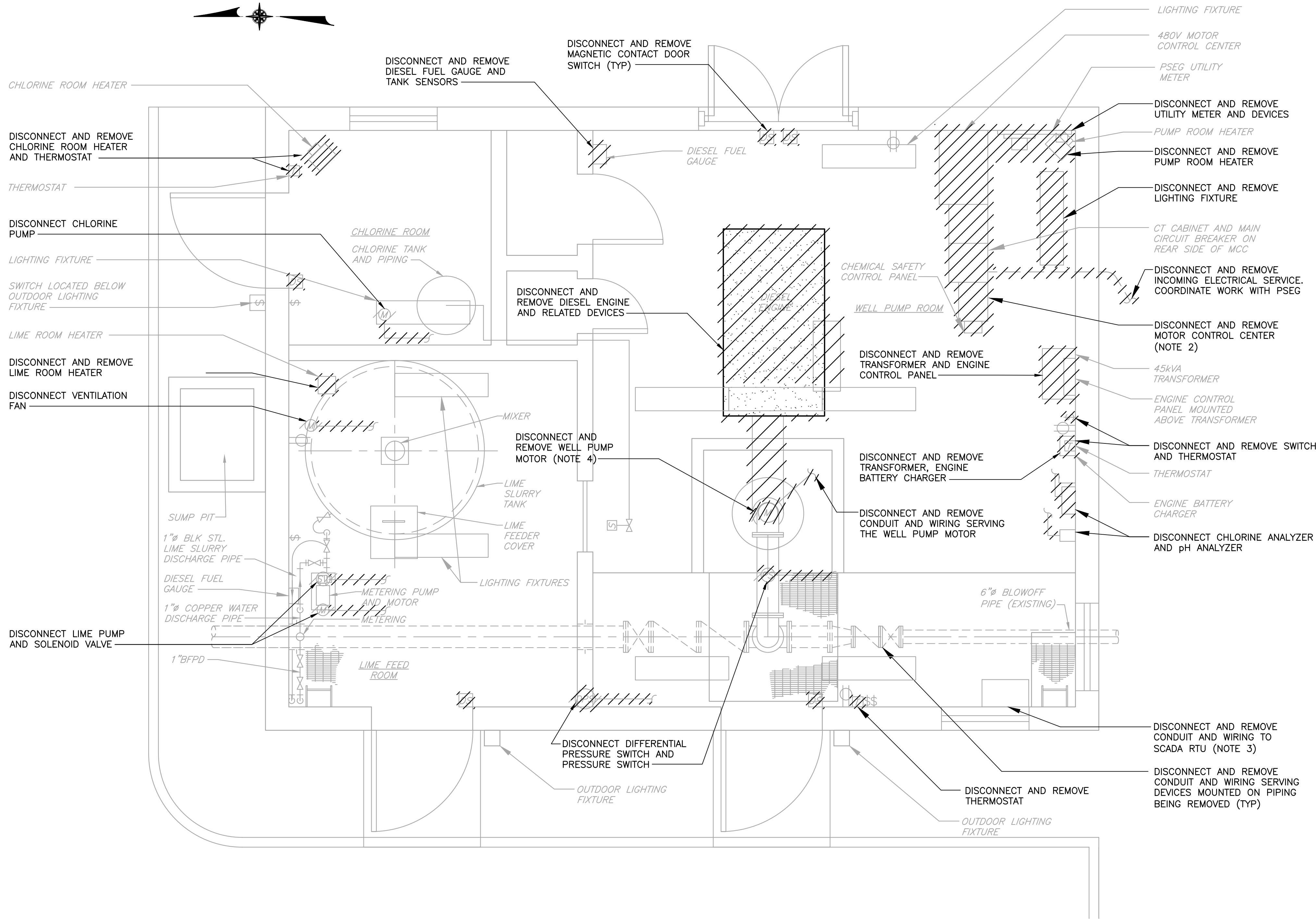
6"BLW

6"BLW

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NOTES:

- 1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
- 2. CONTRACTOR SHALL TAKE NOTE OF ALL LIGHTING, RECEPTACLE, METERING PUMP, HEATER AND OTHER EQUIPMENT TO REMAIN.
- 3. SCADA RTU WILL BE REPLACED UNDER THE PLUMBING CONTRACT.
- 4. ALL CONDUIT AND WIRE RELATED TO ITEMS AND EQUIPMENT REMOVED UNDER DEMOLITION SHALL BE DISCONNECTED AND REMOVED.
- 5. THE OWNER HAS THE OPTION OF KEEPING ANY EQUIPMENT DISCONNECTED UNDER DEMOLITION. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL EQUIPMENT THAT THE OWNER DOES NOT WISH TO KEEP.

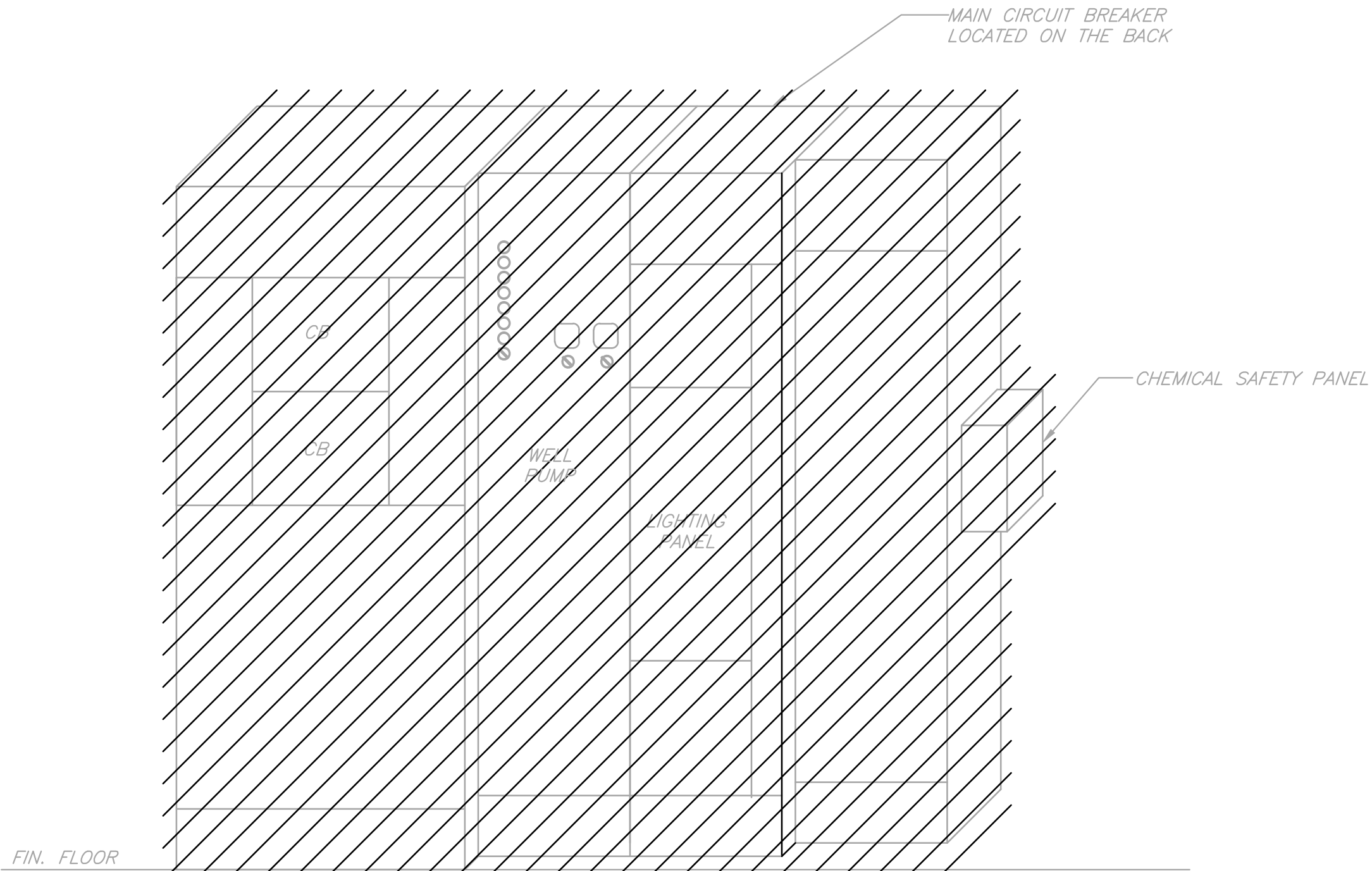
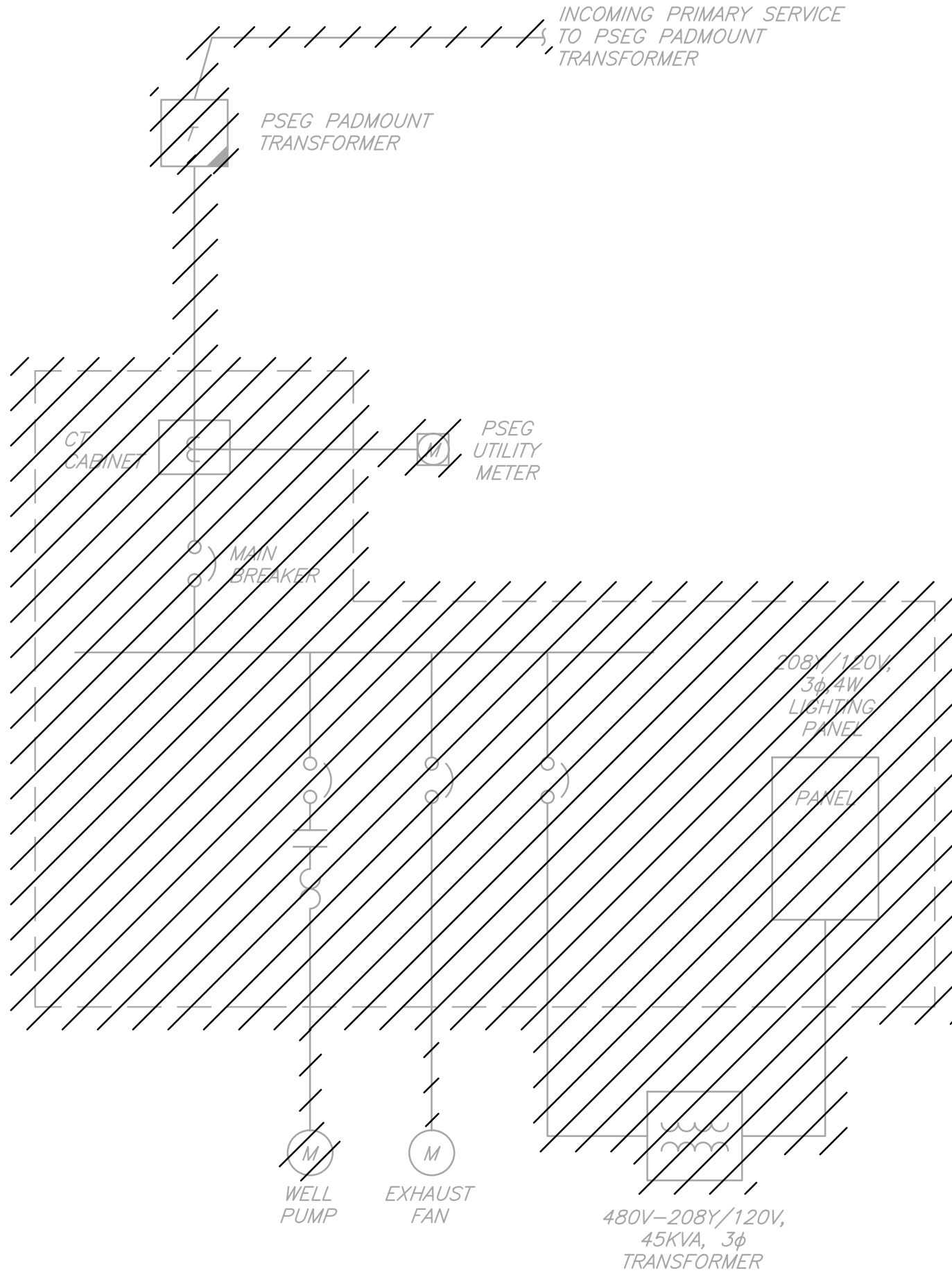


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NOTES:
1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.

DISCONNECT AND REMOVE PANELBOARD.
CONTRACTOR SHALL MAINTAIN EXISTING
CONDUIT AND WIRING WITH ADEQUATE
WIRE LENGTH FOR RECONNECTION OF
CIRCUITS TO REMAIN TO BE
RECONNECTED TO NEW PANELBOARD.

DEMOLITION PANELBOARD - LP				
CKT NO.	DEVICE	LOAD DESIGNATION	LOAD	BRANCH CIRCUIT
	POLE TRIP		M.P. [KW]	
3	-	PUMP ROOM HEATER		EXISTING TO BE REMOVED
5	-			
9	-	CHLORINE ROOM HEATER		EXISTING TO BE REMOVED
11	-			
13	-	CHLORINE PUMP		CONNECT TO NEW CHEM SAFETY PNL
15	-			
17	-			
19	-	LIME ROOM HEATER		EXISTING TO BE REMOVED
21	-			
23	1	TREATMENT CONTROL		CONNECT TO NEW PANEL UPW
25	-	BATHROOM LIGHTS		CONNECT TO NEW PANEL UPW
27	1	BATHROOM LIGHTS		CONNECT TO NEW PANEL UPW
29	1	LIME RM. AND BASEMENT RECEPT.		CONNECT TO NEW PANEL UPW
31	1	LIME RM. AND BASEMENT LIGHTS		CONNECT TO NEW PANEL UPW
33	1	LIME MIXER AND FAN		CONNECT TO NEW PANEL UPW
35	1	PUMP RM. AND OUTSIDE LIGHTS		CONNECT TO NEW PANEL UPW
37	1	PUMP ROOM LIGHTS		CONNECT TO NEW PANEL UPW
39	1	CHLORINE RM. FAN AND LIGHTS		CONNECT TO NEW PANEL UPW
41	1	SPACE		
2	3	LIME PUMP		CONNECT TO NEW CHEM SAFETY PNL
4	-			
6	-			
8	1	PIPE TRENCH RECEPTACLES		CONNECT TO NEW PANEL UPW
10	1	PIPE TRENCH LIGHTS		CONNECT TO NEW PANEL UPW
12	1	FEED TELEMETERING		CONNECT TO NEW PANEL UPW
14	1	CHEMICAL CONTROL PANEL		EXISTING TO BE REMOVED
16	-	SPACE		
18	-	SPACE		
20	-	SPACE		
22	-	SPACE		
24	-	SPACE		
26	-	SPACE		
28	-	SPACE		
30	-	SPACE		
32	-	SPACE		
34	-	SPACE		
36	-	SPACE		
38	-	SPACE		
40	-	SPACE		
42	-	SPACE		
MAIN BUS: 150A		TYPE: BOLT-ON	MOUNTING: IN MCC	
MAIN: 120A MCB		VOLTS: 208/120V		
FEEDER: EXISTING TO BE REMOVED		PHASE: 3PH, 4W+GND		

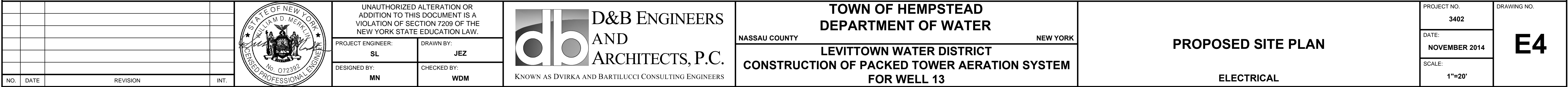


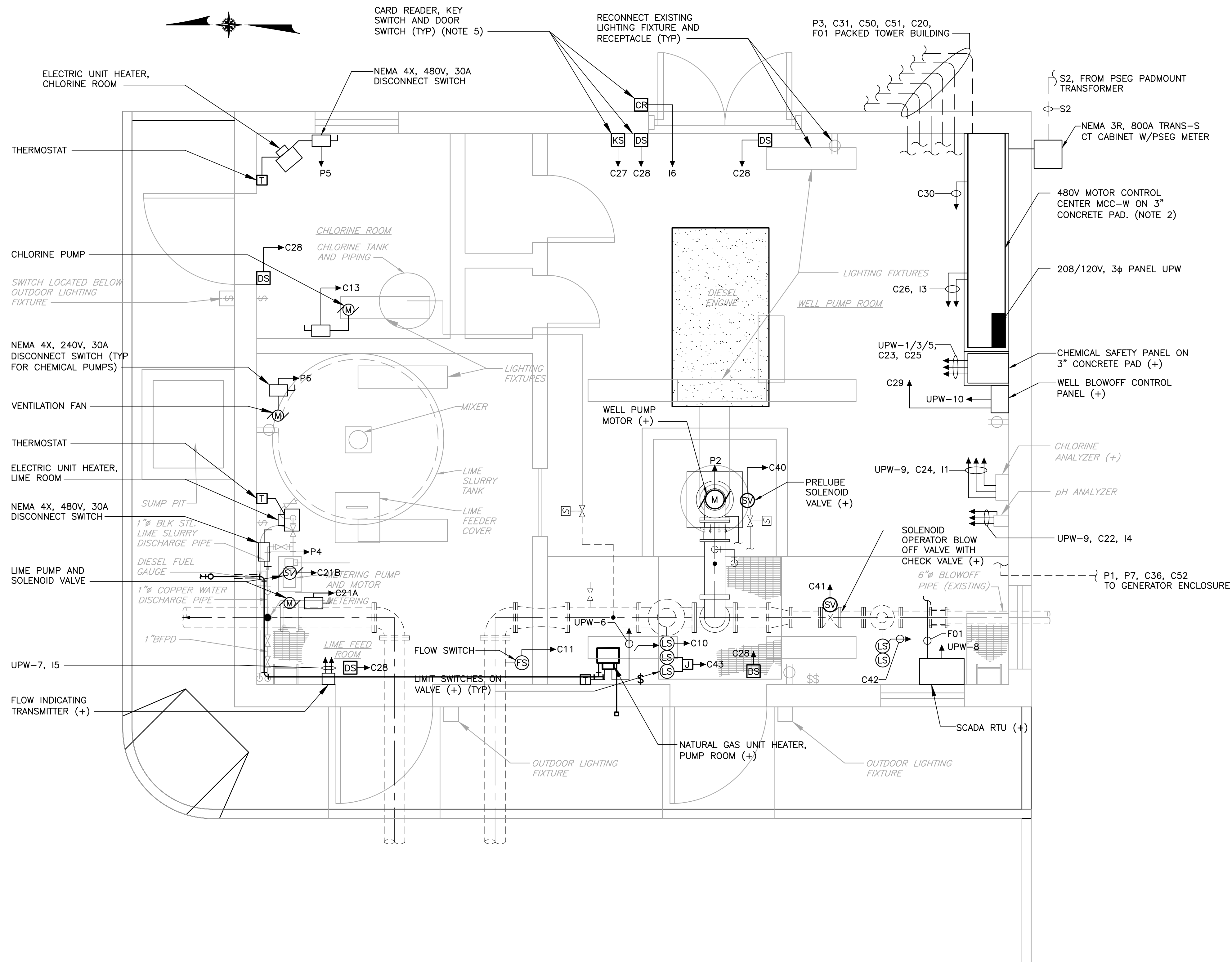
SINGLE LINE DIAGRAM: MOTOR CONTROL CENTER — DEMOLITION

SCALE: N.T.S.

ELEVATION: MOTOR CONTROL CENTER — DEMOLITION

SCALE: N.T.S.



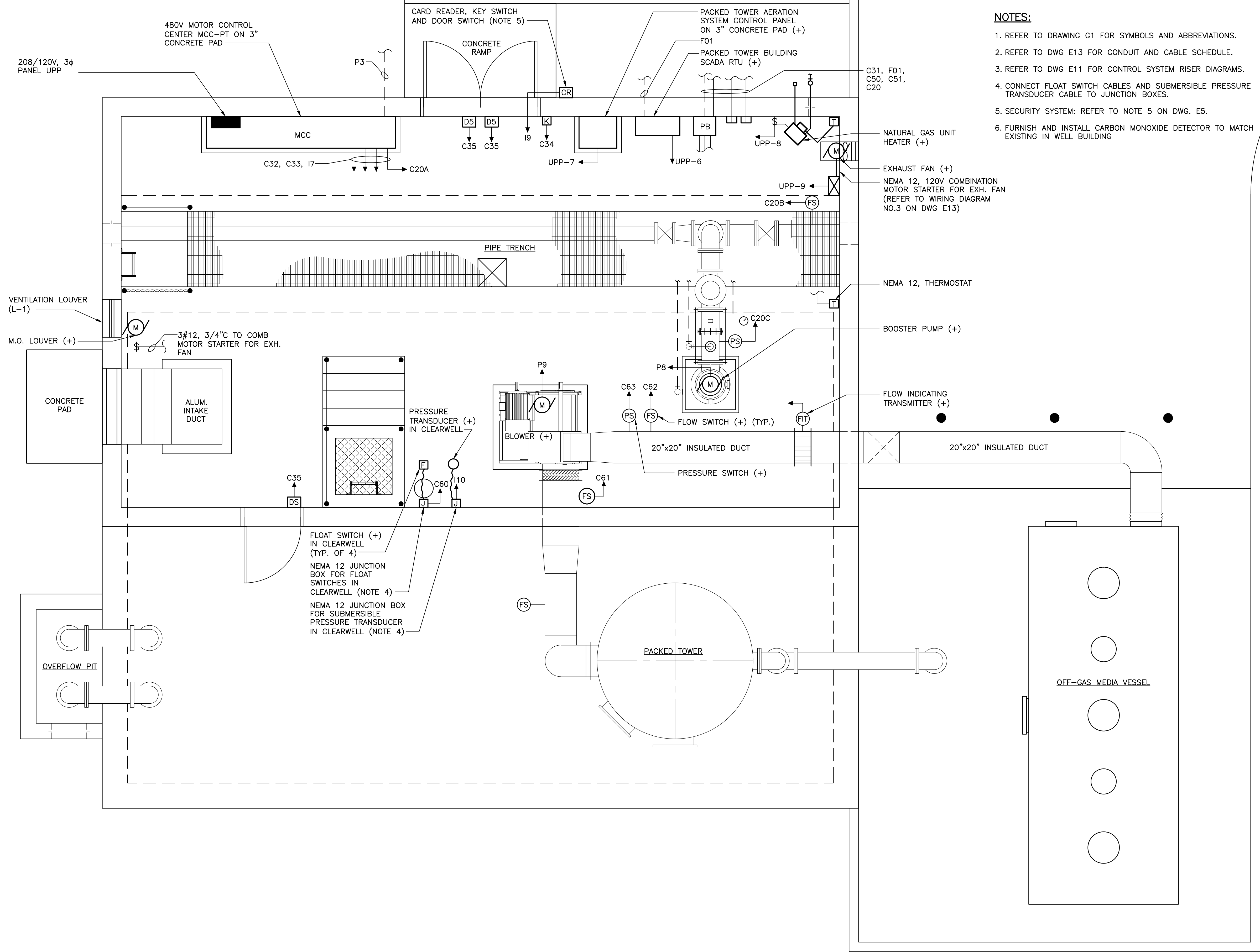


NOTES:

1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
2. CONTRACTOR SHALL RECONNECT ALL CONDUIT AND WIRING FOR EQUIPMENT WHICH IS TO REMAIN AFTER DEMOLITION, INCLUDING LIGHTING, RECEPTACLES, INSTRUMENTS, ETC. EXTEND WIRING AS REQUIRED.
3. REFER TO DWG. E11 FOR CONTROL SYSTEM RISER DIAGRAMS.
4. REFER TO DWG. E13 FOR CONDUIT AND CABLE SCHEDULE.
5. SECURITY SYSTEM:

- FOR EACH DOOR, FURNISH AND INSTALL A MAGNETIC DOOR SWITCH. SWITCH SHALL BE SENTROL 1047-W OR APPROVED EQUAL.
- FURNISH AND INSTALL A CARD READER. CARD READER SHALL BE ISONAS RC-03 PRX AND SHALL BE COMPATIBLE WITH EXISTING TOWN HID CARDS.
- FURNISH AND INSTALL A KEY SWITCH. KEY SWITCH SHALL BE 2 POSITION (ENABLE ALARM, DISABLE ALARM). THE KEY SWITCH CYLINDER SHALL BE INTERCHANGEABLE AND MATCHED TO THE TOWN'S KEY PATTERN.
- PROGRAMMING AND INTEGRATION INTO TOWN'S SYSTEM BY THE PLUMBING CONTRACTOR.

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NO.	DATE	REVISION	INT.		



UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			
PROJECT ENGINEER:		DRAWN BY:	
SL		MC	
DESIGNED BY:		CHECKED BY:	
MN/MC		WDM	



**D&B ENGINEERS
AND
ARCHITECTS, P.C.**
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

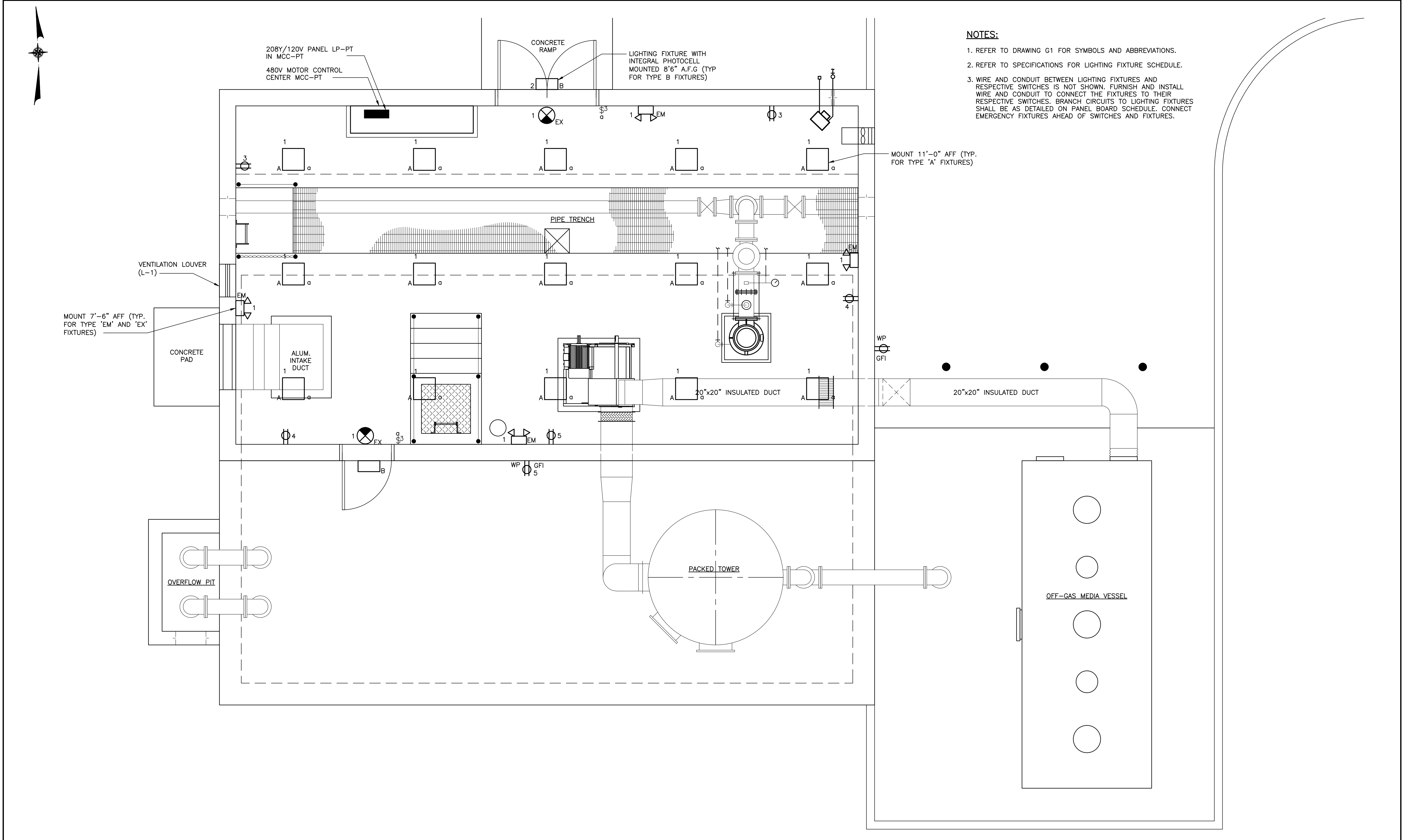
**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**

NASSAU COUNTYNEW YORK

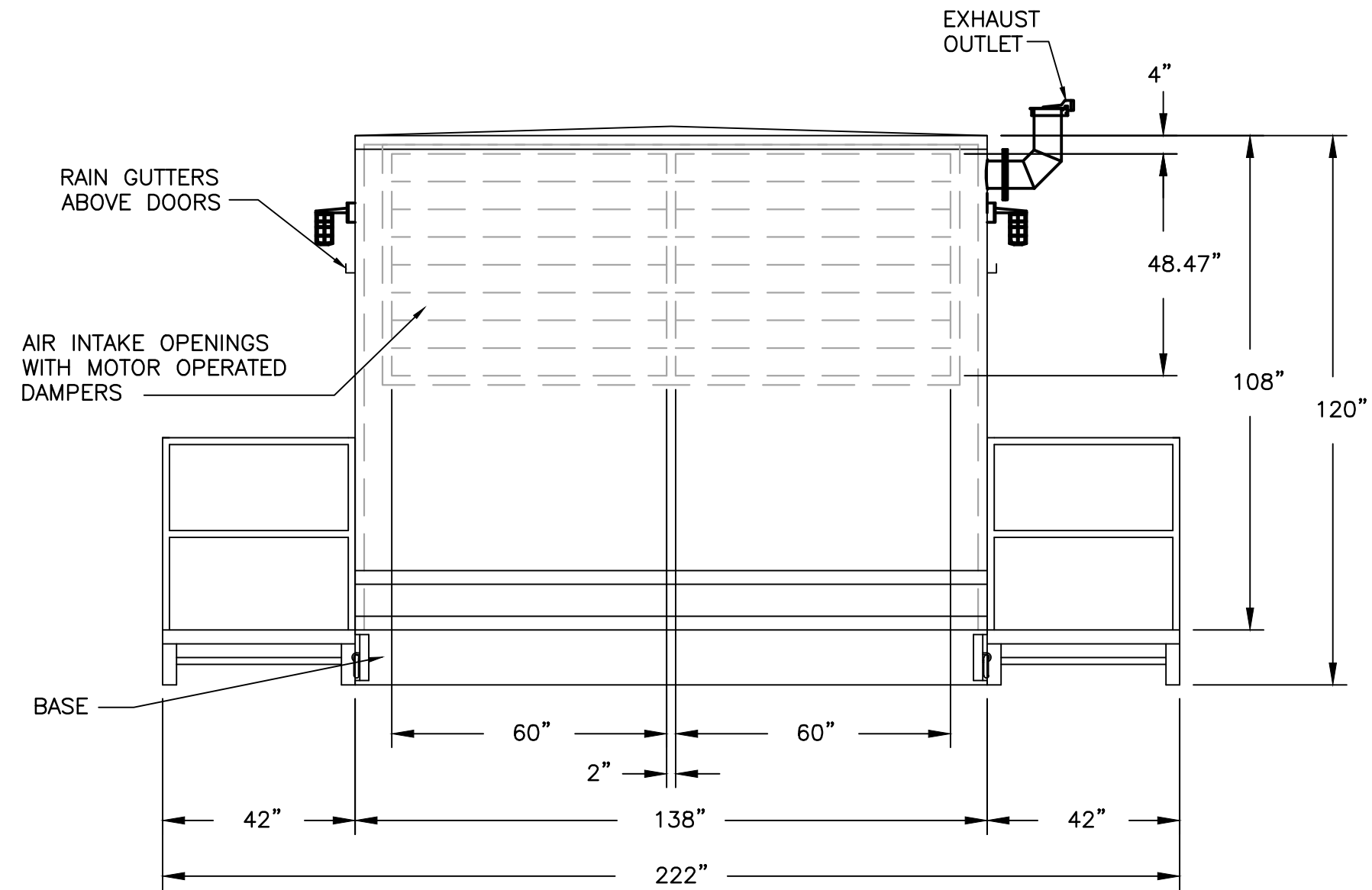
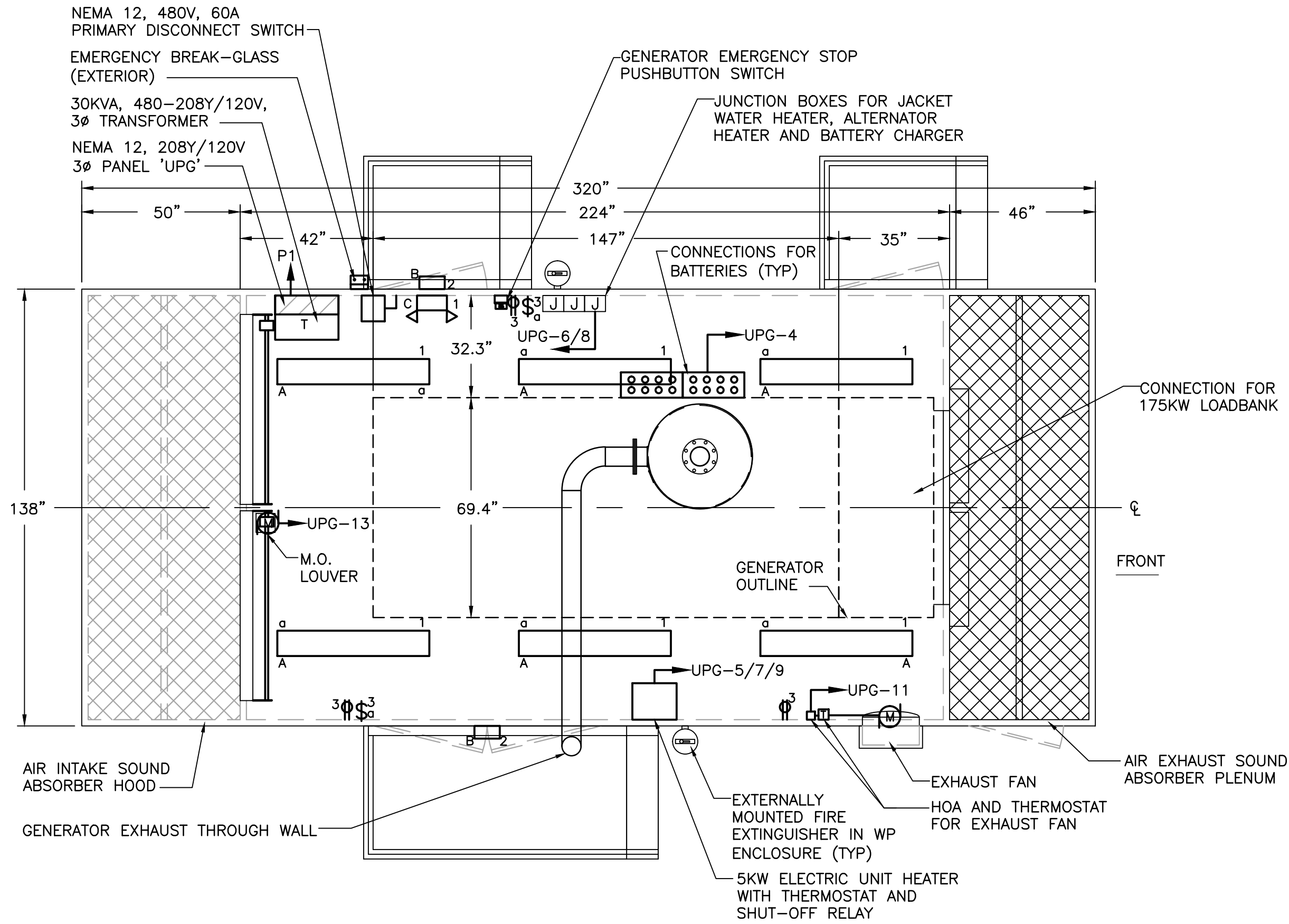
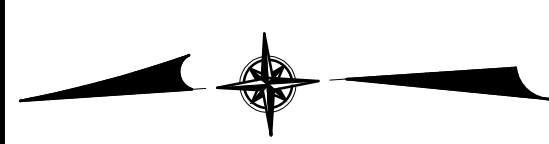
**LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

**PACKED TOWER BUILDING
POWER PLAN**
ELECTRICAL

PROJECT NO. 3402	E6
DATE: NOVEMBER 2014	
SCALE: 3/8"=1'-0"	

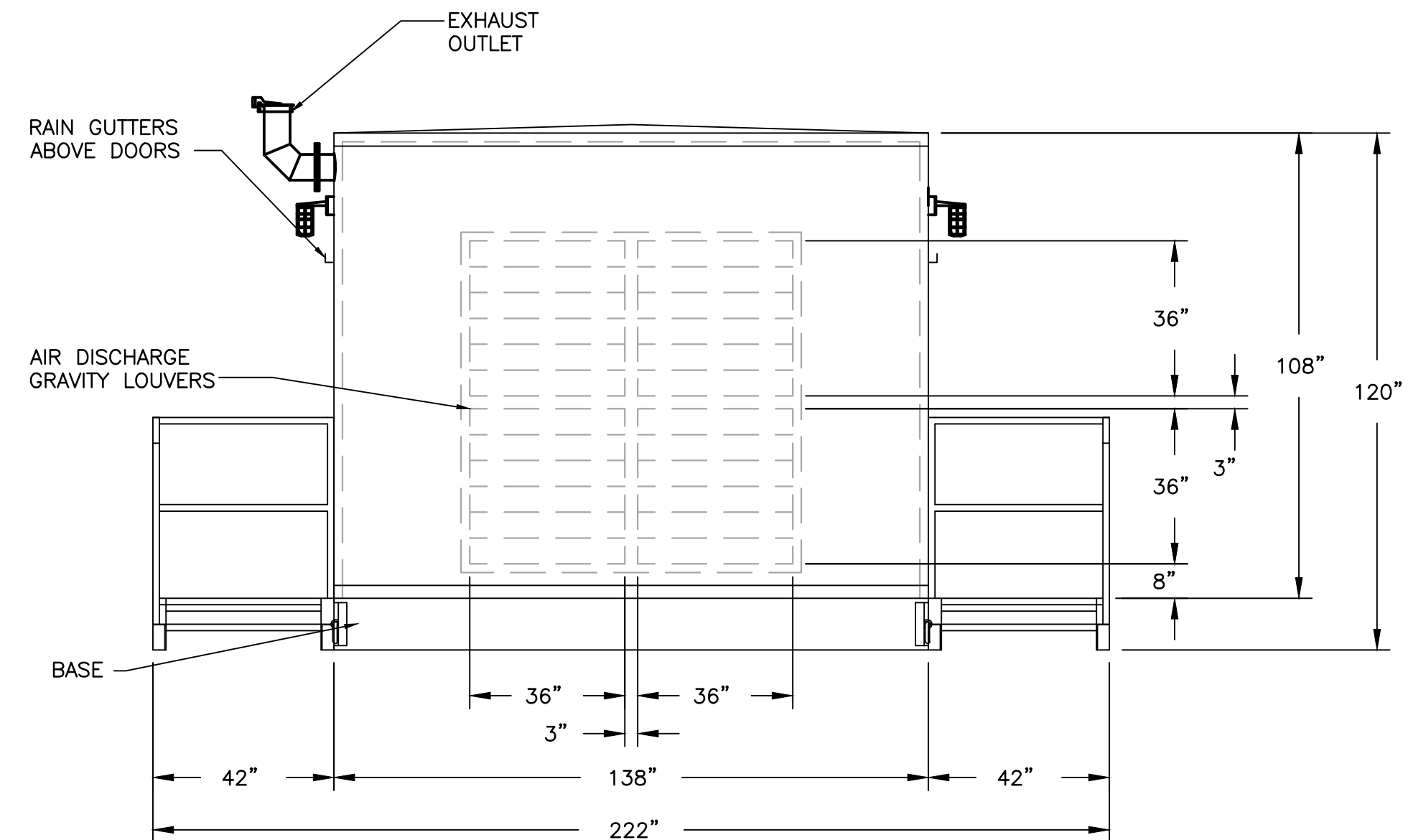
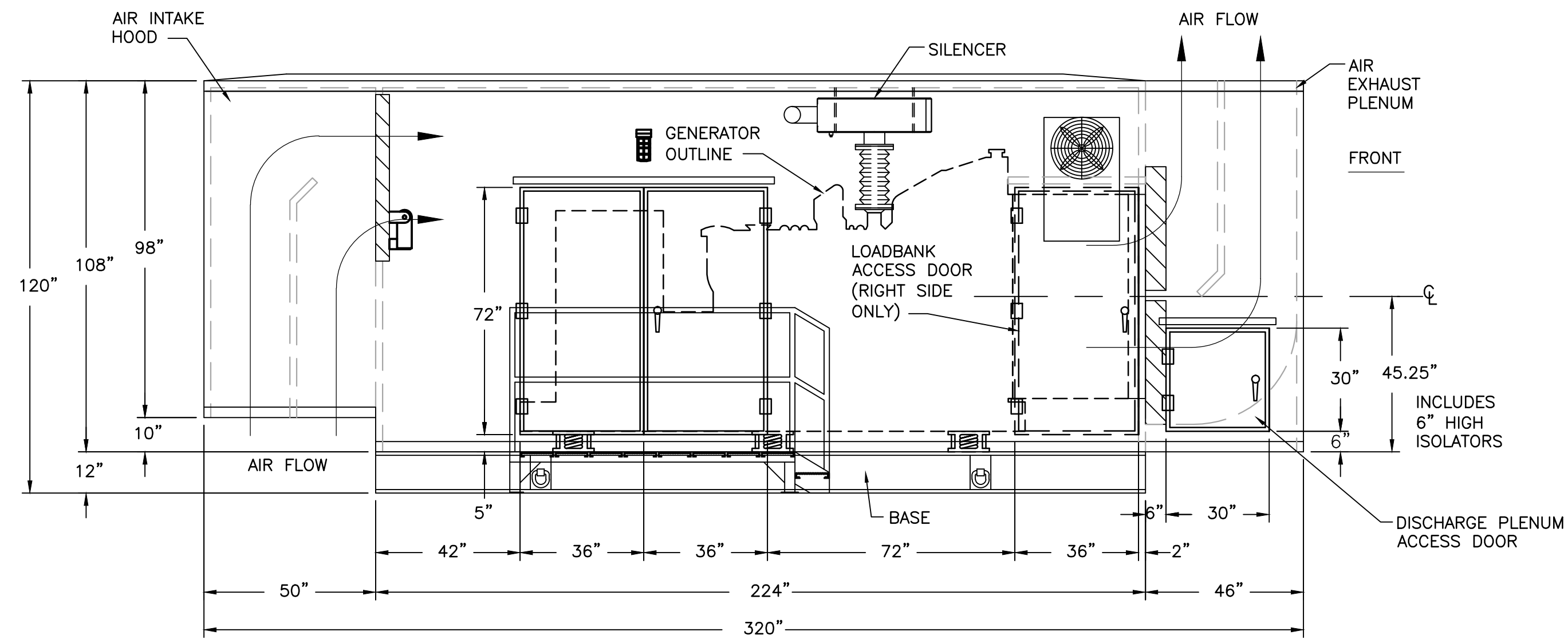


- NOTES:**
1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
 2. REFER TO SPECIFICATIONS FOR LIGHTING FIXTURE SCHEDULE.
 3. WIRE AND CONDUIT BETWEEN LIGHTING FIXTURES AND RESPECTIVE SWITCHES IS NOT SHOWN. FURNISH AND INSTALL WIRE AND CONDUIT TO CONNECT THE FIXTURES TO THEIR RESPECTIVE SWITCHES. BRANCH CIRCUITS TO LIGHTING FIXTURES SHALL BE AS DETAILED ON PANEL BOARD SCHEDULE. CONNECT EMERGENCY FIXTURES AHEAD OF SWITCHES AND FIXTURES.



NOTES:

1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
2. COORDINATE ELECTRICAL STUB-UP AREA DURING FOUNDATION CONSTRUCTION.
3. MOUNTING CHANNELS SHALL BE PROVIDED WITH 3/4"Ø BOLT HOLES FOR ENCLOSURE MOUNTING.
4. ALL DOOR HARDWARE SHALL BE STAINLESS STEEL.
5. ENCLOSURE AND ENCLOSURE ACCESSORIES SHALL BE FABRICATED, INSTALLED AND DELIVERED BY ORIGINAL EQUIPMENT MANUFACTURER. ALL ACCESSORIES SHOWN AND SPECIFIED SHALL BE FULLY INSTALLED, WIRED AND TESTED PRIOR TO DELIVERY.
6. THE INTAKE AIR LOUVER SHALL BE SPRING LOADED TO OPERATE UPON LOSS OF POWER. THE SOLENOID OPERATOR SHALL HOLD THE LOUVER CLOSED WHENEVER THE ELECTRIC UTILITY POWER IS AVAILABLE AND THE GENERATOR ENGINE IS NOT RUNNING. THE LOUVER SHALL ALWAYS BE OPEN IF THE GENERATOR ENGINE IS RUNNING. A CONTACT SHALL BE AVAILABLE IN THE GENERATOR CONTROL PANEL TO FACILITATE THIS FUNCTION.
7. WIRING AND CONDUIT FOR LIGHTS AND RECEPTACLES IS NOT COMPLETELY SHOWN. FURNISH AND INSTALL WIRE AND CONDUIT AND CONNECT AS REQUIRED.
8. MOUNT EXTERIOR LIGHT FIXTURES 9'—3" ABOVE GRADE.
9. FURNISH AND INSTALL ALL NECESSARY GAS PIPING IN ACCORDANCE WITH GENERATOR SET MANUFACTURER'S RECOMMENDATIONS AND KEYSpan REQUIREMENTS. FURNISH AND INSTALL SHUTOFF VALVE AT GAS INLET CONNECTION.
10. CONNECT SYSTEM GROUND TO GROUND PADS.



NO.	DATE	REVISION	INT.



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SL		MC	
DESIGNED BY:		CHECKED BY:	
MN		WDM	



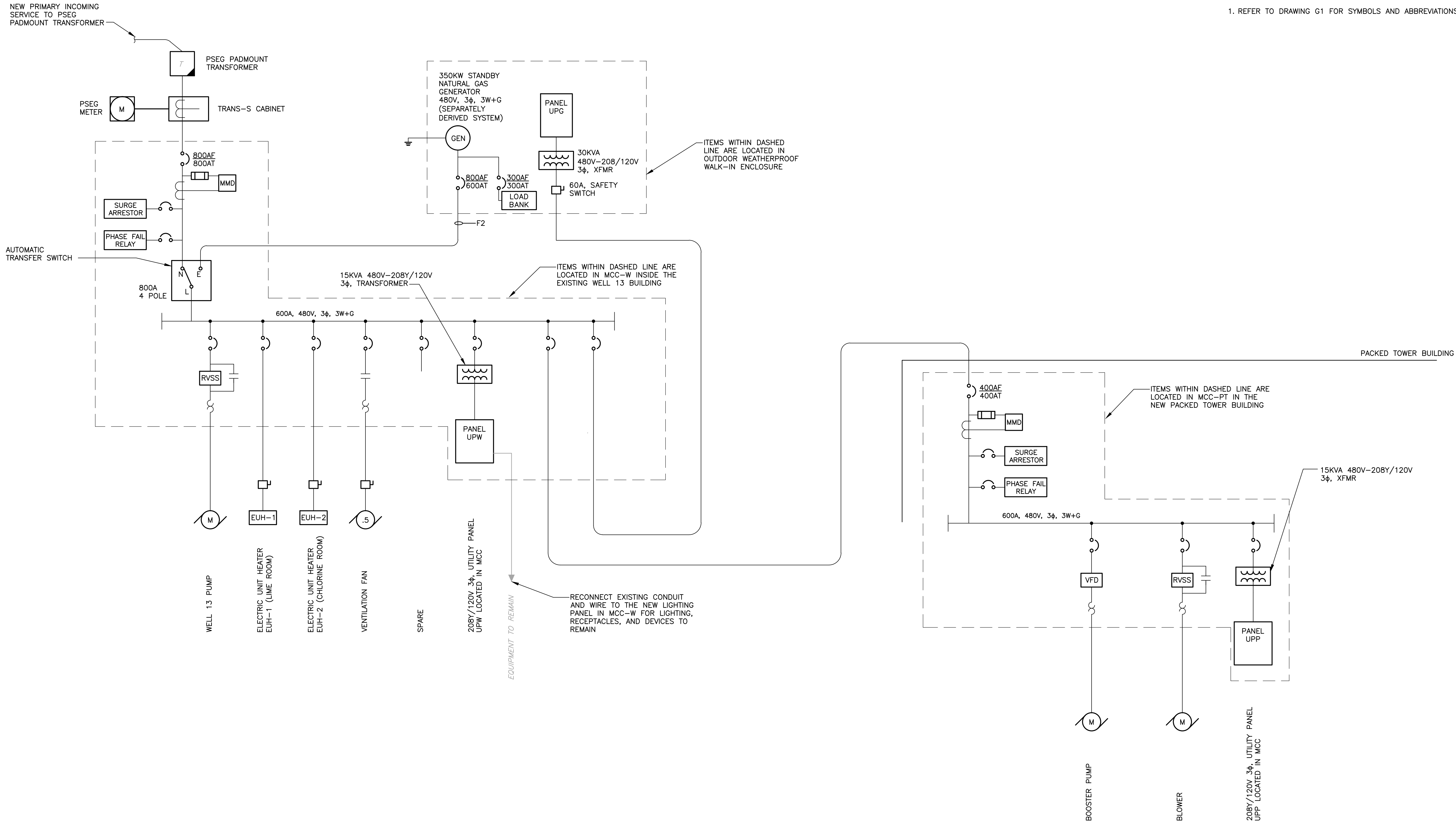
TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

GENERATOR SET ENCLOSURE
PLAN AND ELEVATIONS

ELECTRICAL

PROJECT NO. 3402	E8
DATE: NOVEMBER 2014	
SCALE: N.T.S.	

NOTES:
1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.



NO.	DATE	REVISION	INT.



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MN		WDM	



**D&B ENGINEERS
AND
ARCHITECTS, P.C.**

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NASSAU COUNTYNEW YORK

**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**

LEVITTOWN WATER DISTRICT

**CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

**MOTOR CONTROL CENTERS MCC-W
AND MCC-PT SINGLE LINE DIAGRAMS**

ELECTRICAL

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: N.T.S.

DRAWING NO.

E9

1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.



SCALE: N.T.S.



SCALE: N.T.S

VOLTS	480V
BUS AMPS	800A
PHASE	3PH,3W+GND
AIC	65,000 AMPS

VOLTS	480V
BUS AMPS	600A
PHASE	3PH,3W+GND
AIC	65,000 AMPS

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PROJECT ENGINEER:
SL

DRAWN BY: MC

DESIGNED BY:

CHECKED BY _____



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AND
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KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NASSAU COUNTY

NEW YORK

**LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

MOTOR CONTROL CENTER MCC-W AND MCC-PT ELEVATIONS

ELECTRICAL

PROJECT NO.

3402

DATE:

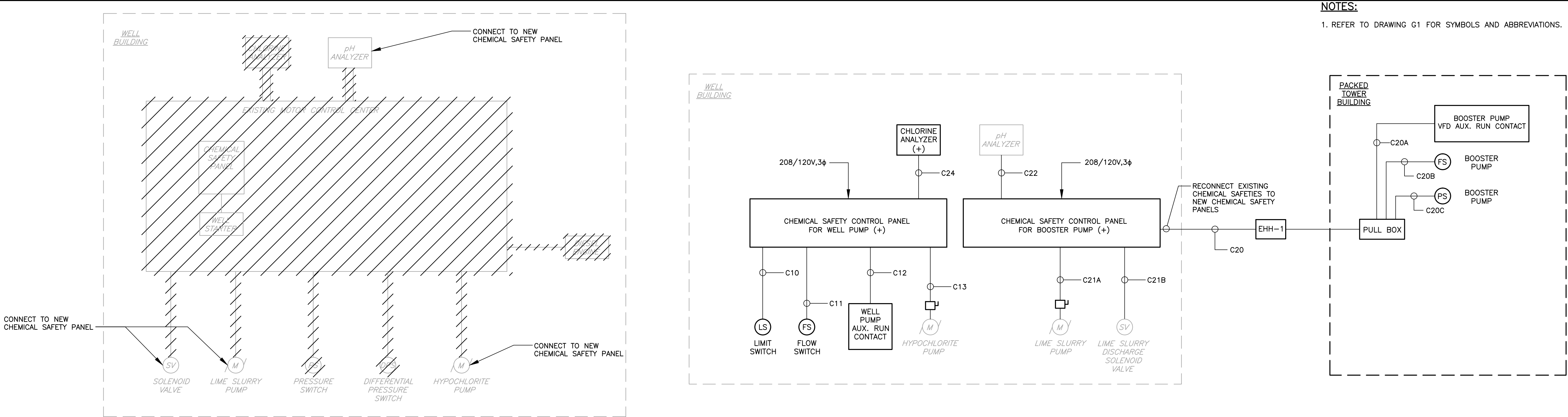
NOVEMBER 2014

SCALE

N.T.S.

DRAWING NO.

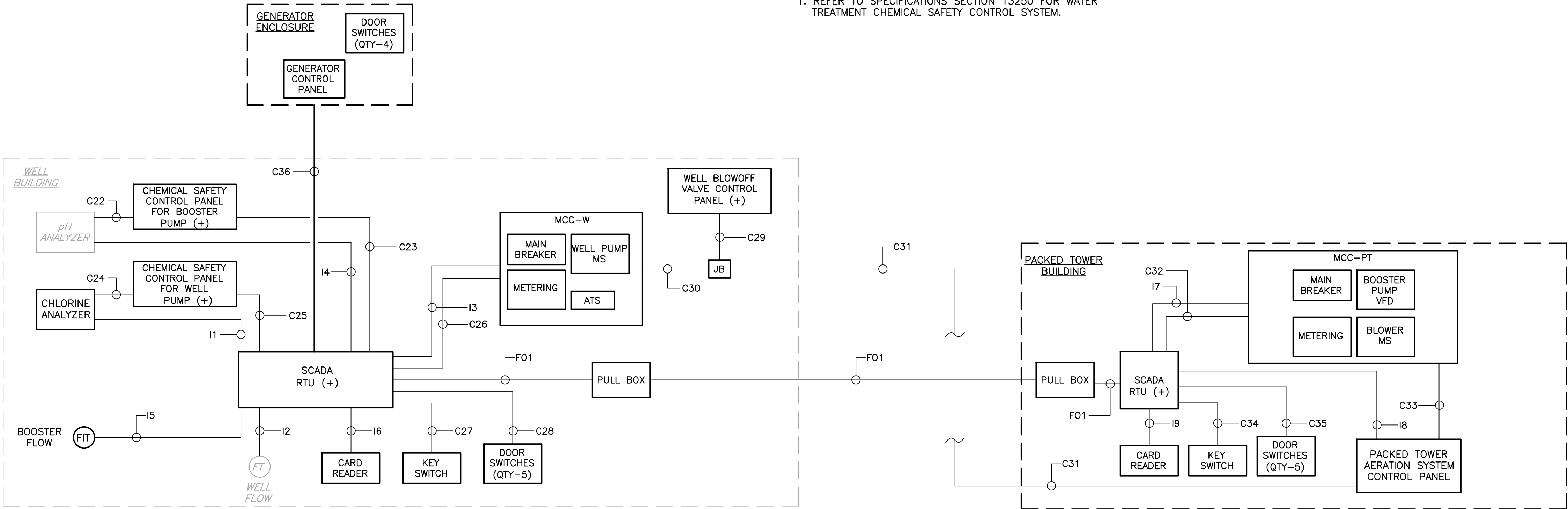
E10



RISER DIAGRAM: CHEMICAL SAFETY SYSTEM – DEMOLITION
N.T.S.

RISER DIAGRAM: CHEMICAL SAFETY SYSTEM – NEW WORK
N.T.S.

NOTE:
1. REFER TO SPECIFICATIONS SECTION 13250 FOR WATER TREATMENT CHEMICAL SAFETY CONTROL SYSTEM.

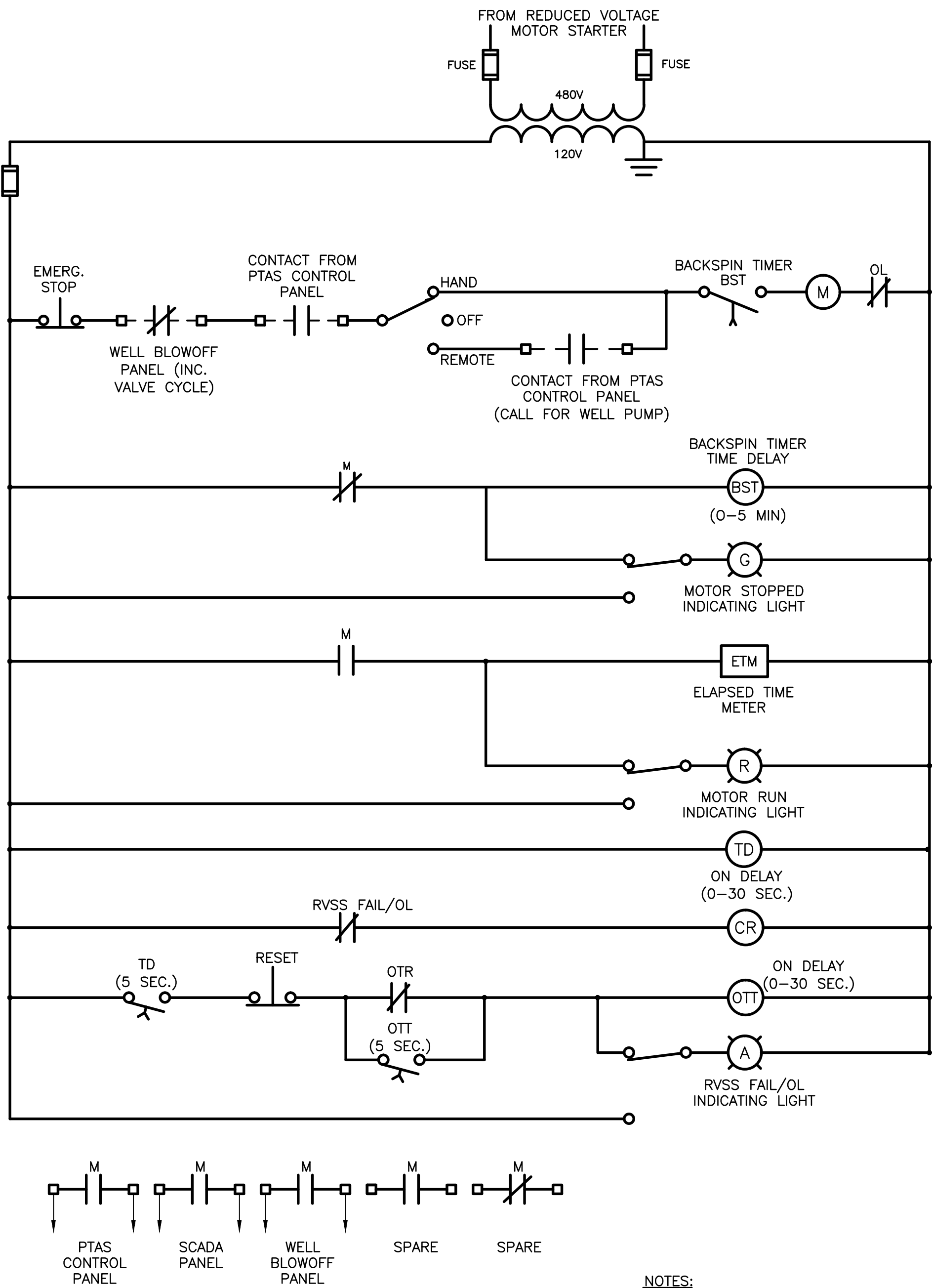


RISER DIAGRAM: SCADA SYSTEM – NEW WORK
N.T.S.

NOTE:
1. REFER TO SPECIFICATION SECTION 13600 FOR SCADA SYSTEM MODIFICATIONS.

NOTES:

1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.

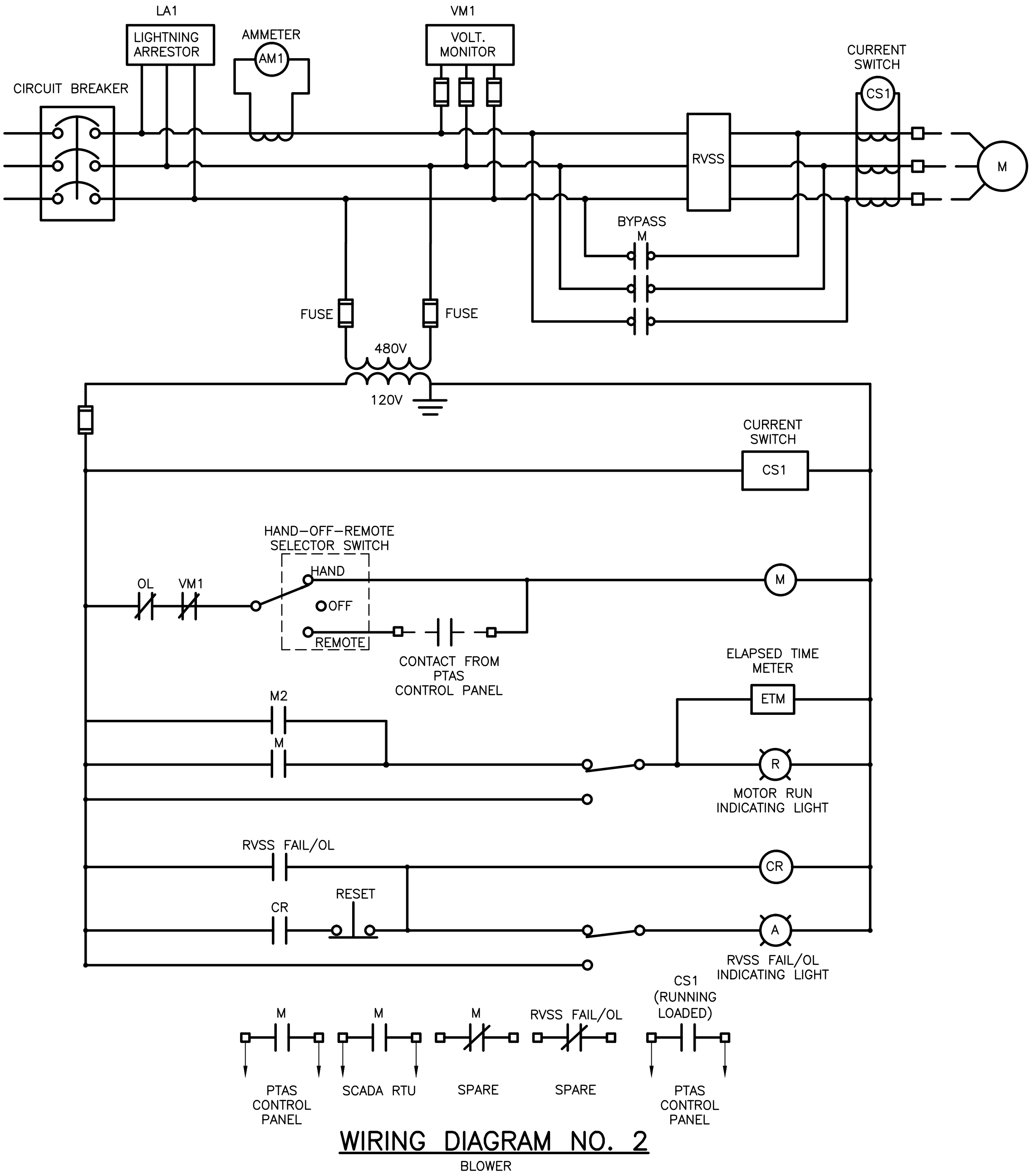


WIRING DIAGRAM NO. 1

WELL 13 PUMP

NOTES:

1. MOTOR STARTER SHALL BE REDUCED VOLTAGE, SOLID STATE.
2. MOTOR STARTER SHALL CONTAIN SINGLE PHASE AMMETER AND CURRENT TRANSFORMER.
3. MOTOR STARTER SHALL CONTAIN SURGE ARRESTOR.
4. MOTOR STARTER SHALL CONTAIN CONTROLS FOR PRELUBE SOLENOID VALVE.
5. REFER TO SPECIFICATION SECTION 16920 FOR CONTROL ACCESSORIES. NOT ALL CONTROLS ARE SHOWN ON THE WIRING DIAGRAM.




NOTES:

1. MOTOR STARTER SHALL BE REDUCED VOLTAGE, SOLID STATE.
2. MOTOR STARTER SHALL CONTAIN SURGE ARRESTOR.
3. MOTOR STARTER SHALL CONTAIN AMMETER, VOLTMETER, UNDER CURRENT MONITORING, PHASE LOSS MONITORING. REFER TO SPECIFICATIONS FOR DETAILS.
4. BLOWER CONTROL CIRCUIT SHALL HAVE CONTROLS IN ACCORDANCE WITH SPECIFICATION SECTION 16920 (MAY NOT BE SHOWN ON WIRING DIAGRAM ABOVE).
5. PTAS = PACKED TOWER AERATION SYSTEM.

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PROJECT ENGINEER:		DRAWN BY:	
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DESIGNED BY:		CHECKED BY:	
MN		WDM	



**D&B ENGINEERS
AND
ARCHITECTS, P.C.**

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

**TOWN OF HEMPSTEAD
DEPARTMENT OF WATER**

NASSAU COUNTYNEW YORK

**LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM
FOR WELL 13**

WIRING DIAGRAMS I

ELECTRICAL

PROJECT NO. 3402
DATE: NOVEMBER 2014
SCALE: N.T.S.

DRAWING NO.

E12



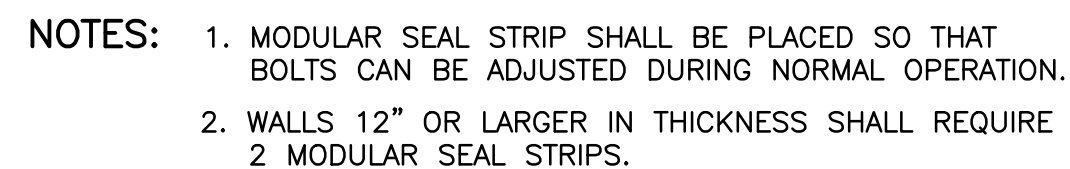
1. CONTROL CIRCUIT SHALL BE IN FAN MOTOR STARTER CENTER COMPARTMENT.



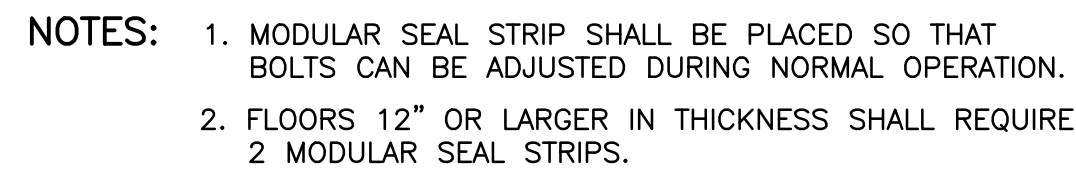
1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.



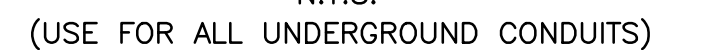
1. CONTROL CIRCUIT SHALL BE IN FAN MOTOR STARTER CENTER COMPARTMENT. (TYP. FOR EACH FAN).



(USE FOR ALL WALL PENETRATIONS)
N.T.S.



(USE FOR ALL FLOOR PENETRATIONS)
N.T.S.



KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NEW YORK

ELECTRICAL

 SAVING NO.

E13

- NOTES:
1. REFER TO DRAWING G1 FOR SYMBOLS AND ABBREVIATIONS.
 2. EXISTING UTILITY PANELS SHALL BE REMOVED UNDER DEMOLITION AND REPLACED WITH NEW UTILITY PANELS. EXISTING BRANCH CIRCUITS SHALL BE EXTENDED TO CONNECT TO THE NEW UTILITY PANELBOARDS, UNLESS NOTED OTHERWISE. VERIFY LOCATIONS OF EXISTING LOADS AND EXISTING WIRING.

CONDUIT AND CABLE SCHEDULE					
CONDUIT		CABLE	FROM	TO	REMARKS
NUMBER	SIZE				
S1	3" (EXIST)	3-2/C#2 ALUM, 15KV	PSEG RISER POLE,WEST SIDE OF WANTACH AVE	EXISTING PROPERTY LINE BOX	PRIMARY SERVICE
S1A	2-4"	3-2/C#2 ALUM, 15KV	EXISTING PROPERTY LINE BOX	PSEG PADMOUNT TRANSFORMER	PRIMARY SERVICE, 1 SPARE CONDUIT
S2	2-4"	2 SETS OF 4-500KCMIL	PSEG PADMOUNT TRANSFORMER	MOTOR CONTROL CENTER MCC-W	VIA 800A TRANS-S CABINET
P1	2-4"	2 SETS 3-500KCMIL, 1/0G	GENERATOR SET	MOTOR CONTROL CENTER MCC-W	TO AUTOMATIC TRANSFER SWITCH
P2	1.5"	3#1, #6G	WELL PUMP	MOTOR CONTROL CENTER MCC-W	TO WELL PUMP MOTOR STARTER
P3	4"	3-500KCMIL, #2G	MOTOR CONTROL CENTER MCC-PT	MOTOR CONTROL CENTER MCC-W	FEEDER TO PACKED TOWER BUILDING
P4	3/4"	3#12, #12G	ELECTRIC UNIT HEATER, LIME ROOM	MOTOR CONTROL CENTER MCC-W	
P5	3/4"	3#12, #12G	ELECTRIC UNIT HEATER, CHLORINE ROOM	MOTOR CONTROL CENTER MCC-W	
P6	3/4"	3#12, #12G	VENTILATION FAN	MOTOR CONTROL CENTER MCC-W	
P7	1"	3#6,#10G	GENERATOR BUILDING	MOTOR CONTROL CENTER MCC-W	
P8	2"	3-3/0, #6G	BOOSTER PUMP	MOTOR CONTROL CENTER MCC-PT	
P9	1.25"	3#4, #10G	BLOWER	MOTOR CONTROL CENTER MCC-PT	
C10	3/4"	2#14	LIMIT SWITCH, WELL PUMP	CHEM. SAFETY CONTROL PANEL, WELL PUMP	
C11	3/4"	5#14	FLOW SWITCH, WELL PUMP	CHEM. SAFETY CONTROL PANEL, WELL PUMP	
C12	3/4"	2#14	WELL PUMP AUXILIARY RUN CONTACT	CHEM. SAFETY CONTROL PANEL, WELL PUMP	
C13	3/4"	3#12, #12G	HYPOCHLORITE PUMP	CHEM. SAFETY CONTROL PANEL, WELL PUMP	
C20	3/4"	13#14	CHEM. SAFETY CONTROL PANEL, BOOSTER PUMP	PULL BOX, PACKED TOWER BUILDING	
C20A	3/4"	2#14	PULL BOX, PACKED TOWER BUILDING	BOOSTER PUMP VFD AUXILIARY RUN CONTACT	
C20B	3/4"	5#14	PULL BOX, PACKED TOWER BUILDING	FLOW SWITCH, BOOSTER PUMP	
C20C	3/4"	2#14	PULL BOX, PACKED TOWER BUILDING	PRESSURE SWITCH, BOOSTER PUMP	
C21	3/4"	NOT USED			
C21A	3/4"	3#12,#12G	LIME SLURRY PUMP	CHEM. SAFETY CONTROL PANEL, BOOSTER PUMP	
C21B	3/4"	3#14	LIME SLURRY DISCHARGE SOLENOID VALVE	CHEM. SAFETY CONTROL PANEL, BOOSTER PUMP	
C22	3/4"	2#14	pH ANALYZER	CHEM. SAFETY CONTROL PANEL, BOOSTER PUMP	
C23	3/4"	12#14	CHEM. SAFETY CONTROL PANEL, BOOSTER PUMP	SCADA RTU, WELL BUILDING	
C24	3/4"	2#14	CHLORINE ANALYZER	CHEM. SAFETY CONTROL PANEL, WELL PUMP	
C25	3/4"	12#14	CHEM. SAFETY CONTROL PANEL, WELL PUMP	SCADA RTU, WELL BUILDING	
C26	3/4"	12#14	SCADA RTU, WELL BUILDING	MOTOR CONTROL CENTER MCC-W	
C27	3/4"	4#14	KEY SWITCH, WELL BUILDING	SCADA RTU, WELL BUILDING	
C28	3/4"	2#14	DOOR SWITCHES (QUANTITY-5), WELL BUILDING	SCADA RTU, WELL BUILDING	
C29	1"	20#14	WELL BLOWOFF VALVE CONTROL PANEL	JUNCTION BOX	
C30	3/4"	12#14	MOTOR CONTROL CENTER MCC-W	JUNCTION BOX	
C31	1"	24#14	JUNCTION BOX	PACKED TOWER AER. SYSTEM CONTROL PANEL	
C32	3/4"	8#14	SCADA RTU, PACKED TOWER BUILDING	MOTOR CONTROL CENTER MCC-PT	
C33	3/4"	12#14	PACKED TOWER AER. SYSTEM CONTROL PANEL	MOTOR CONTROL CENTER MCC-PT	
C34	3/4"	4#14	KEY SWITCH, PACKED TOWER BUILDING	SCADA RTU, PACKED TOWER BUILDING	
C35	3/4"	2#14	DOOR SWITCHES (QTY-5), PACKED TOWER BLDG	SCADA RTU, PACKED TOWER BUILDING	
C36	3/4"	6#14	SCADA RTU, WELL BUILDING	GENERATOR ENCLOSURE	
C40	3/4"	3#14	PRELUBE SOLENOID VALVE FOR WELL PUMP	MOTOR CONTROL CENTER MCC-W, WELL PUMP	
C41	3/4"	3#14	SOLENOID VALVE, BLOWOFF VALVE	WELL BLOWOFF VALVE CONTROL PANEL	
C42	3/4"	4#14	LIMIT SWITCHES, BLOWOFF VALVE	WELL BLOWOFF VALVE CONTROL PANEL	
C43	3/4"	4#14	LIMIT SWITCHES, DISCHARGE VALVE	WELL BLOWOFF VALVE CONTROL PANEL	
C50	2"	-	WELL BUILDING	PACKED TOWER BUILDING	SPARE CONDUIT
C51	2"	-	WELL BUILDING	PACKED TOWER BUILDING	SPARE CONDUIT
C52	2"	-	WELL BUILDING	GENERATOR ENCLOSURE	SPARE CONDUIT
C60	3/4"	10#14	JUNCTION BOX FOR FLOAT SWITCH CABLES	PACKED TOWER AERATION SYSTEM CONTROL PNL	
C61	3/4"	5#14	FLOW SWITCH, BLOWER SUCTION	PACKED TOWER AERATION SYSTEM CONTROL PNL	
C62	3/4"	5#14	FLOW SWITCH, BLOWER DISCHARGE	PACKED TOWER AERATION SYSTEM CONTROL PNL	
C63	3/4"	2#14	PRESSURE SWITCH, BLOWER DISCHARGE	PACKED TOWER AERATION SYSTEM CONTROL PNL	
C64	3/4"	4#14	AUTOMATIC TRANSFER SWITCH, MCC-W	GENERATOR COINTROL PANEL	
I1	3/4"	1-2/C#16 SHIELDED	CHLORINE ANALYZER	SCADA RTU, WELL BUILDING	
I2	3/4"	1-2/C#16 SHIELDED	WELL FLOW TRANSMITTER	SCADA RTU, WELL BUILDING	
I3	2"	5-2/C#16 SHIELDED	SCADA RTU, WELL BUILDING	MOTOR CONTROL CENTER MCC-W	
I4	3/4"	1-2/C#16 SHIELDED	pH ANALYZER	SCADA RTU, WELL BUILDING	
I5	3/4"	1-2/C#16 SHIELDED	BOOSTER FLOW INDICATING TRANSMITTER	SCADA RTU, WELL BUILDING	
I6	3/4"	1-10/C#22 SHIELDED	CARD READER, WELL BUILDING	SCADA RTU, WELL BUILDING	
I7	2"	4-2/C#16 SHIELDED	SCADA RTU, PACKED TOWER BUILDING	MOTOR CONTROL CENTER MCC-PT	
I8	3/4"	1-2/C#16 SHIELDED	PACKED TOWER AER. SYSTEM CONTROL PANEL	SCADA RTU, PACKED TOWER BUILDING	
I9	3/4"	1-10/C#22 SHIELDED	CARD READER, PACKED TOWER BUILDING	SCADA RTU, PACKED TOWER BUILDING	
I10	3/4"	1-2/C#16 SHIELDED	JUNCTION BOX FOR PRESSURE XDUCER CABLE	PACKED TOWER AERATION SYSTEM CONTROL PNL	
FO1	3"	4 FIBER	SCADA RTU, WELL BUILDING	SCADA RTU, PACKED TOWER BUILDING	

UTILITY PANEL – UPW					
CKT NO.	DEVICE		LOAD DESIGNATION	LOAD H.P. KVA	BRANCH CIRCUIT
	POLE	TRIP			
1	3	30	CHEM. SAFETY PANEL,WELL/BOOSTER		4#10, #10G-¾"C
3	-	-			
5	-	-			
7	1	20	FLOW INDICATING TRANSMITTER		2#12, #12G-¾"C
9	1	20	pH AND CHLORINE ANALYZER		2#12, #12G-¾"C
11	1	15	TREATMENT CONTROL		2#12, #12G-¾"C (NOTE 2)
13	1	20	BATHROOM LIGHTS		2#12, #12G-¾"C (NOTE 2)
15	1	20	BATHROOM LIGHTS		2#12, #12G-¾"C (NOTE 2)
17	1	-	LIME RM. AND BASEMENTS RECEPT.		2#12, #12G-¾"C (NOTE 2)
19	1	20	LIME RM. AND BASEMENT LIGHTS		2#12, #12G-¾"C (NOTE 2)
21	1	20	LIME MIXER AND FAN		2#12, #12G-¾"C (NOTE 2)
23	1	20	PUMP RM. AND OUTSIDE LIGHTS		2#12, #12G-¾"C (NOTE 2)
25	1	20	PUMP ROOM LIGHTS		2#12, #12G-¾"C (NOTE 2)
27	1	20	CHLORINE RM. FAN AND LIGHTS		2#12, #12G-¾"C (NOTE 2)
29	-	-	SPACE		
31	-	-	SPACE		
33	-	-	SPACE		
35	-	-	SPACE		
37	-	-	SPACE		
39	-	-	SPACE		
41	-	-	SPACE		
2	3	30	SPARE		4#12, #12G-¾"C
4	-	-			
6	-	-			
8	1	20	GAS UNIT HEATER		2#12, #12G-¾"C
10	1	20	SCADA RTU		2#12, #12G-¾"C
12	1	20	BLOWOFF VALVE CONTROL PANEL		2#12, #12G-¾"C
14	1	20	PIPE TRENCH RECEPTACLES		2#12, #12G-¾"C (NOTE 2)
16	1	20	PIPE TRENCH LIGHTS		2#12, #12G-¾"C (NOTE 2)
18	1	15	FEED TELEMETERING		2#12, #12G-¾"C (NOTE 2)
20	-	-	SPACE		
22	-	-	SPACE		
24	-	-	SPACE		
26	-	-	SPACE		
28	-	-	SPACE		
30	-	-	SPACE		
32					
34					
36					
38					
40					
42					
MAIN BUSS: 100A			TYPE: BOLT-ON	MOUNTING: IN MCC	
MAIN: 60 CB			VOLTS: 120/208V	AIC(SYM): 10,000	
FEEDER: IN MCC			PHASE: 3PH 4W+GND	EST. CONN KVA: -	

UTILITY PANEL – UPP					
CKT NO.	DEVICE		LOAD DESIGNATION	LOAD H.P. KVA	BRANCH CIRCUIT
	POLE	TRIP			
1	1	20	INTERIOR LIGHTING		2#12, #12G-¾"C
3	1	20	RECEPTACLES		2#12, #12G-¾"C
5	1	20	RECEPTACLES		2#12, #12G-¾"C
7	1	20	PACKED TOWER AER. CONTROL PANEL		2#12, #12G-¾"C
9	1	20	EXHUST FAN		2#12, #12G-¾"C
11	-	-	SPACE		
13	-	-	SPACE		
15	-	-	SPACE		
17	-	-	SPACE		
19	-	-	SPACE		
21	-	-	SPACE		
23	-	-	SPACE		
25	-	-	SPACE		
27	-	-	SPACE		
29	-	-	SPACE		
31					
33					
35					
37					
39					
41					
2	1	20	EXTERIOR LIGHTING		2#12, #12G-¾"C
4	1	20	RECEPTACLES		2#12, #12G-¾"C
6	1	20	SCADA RTU		2#12, #12G-¾"C
8	1	20	GAS UNIT HEATER		2#12, #12G-¾"C
10	-	-	SPACE		
12	-	-	SPACE		
14	-	-	SPACE		
16	-	-	SPACE		
18	-	-	SPACE		
20	-	-	SPACE		
22	-	-	SPACE		
24	-	-	SPACE		
26	-	-	SPACE		
28	-	-	SPACE		
30	-	-	SPACE		
32					
34					
36					
38					
40					
42					
MAIN BUSS: 100A			TYPE: BOLT-ON	MOUNTING: IN MCC	
MAIN: 60 CB			VOLTS: 120/208V	AIC(SYM): 10,000	
FEEDER: IN MCC			PHASE: 3PH 4W+GND	EST. CONN KVA: -	

STATE OF NEW YORK

WILLIAM D. MERKIN

NO. 072392

LICENSED PROFESSIONAL ENGINEER

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PROJECT ENGINEER:
SL

DRAWN BY:
MC

DESIGNED BY:
MN

CHECKED BY:
WDM

db

D&B ENGINEERS AND ARCHITECTS, P.C.

KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

NASSAU COUNTY

NEW YORK

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER

LEVITTOWN WATER DISTRICT

CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13

CONDUIT AND CABLE SCHEDULE AND PANELBOARD SCHEDULES

ELECTRICAL

PROJECT NO.
3402

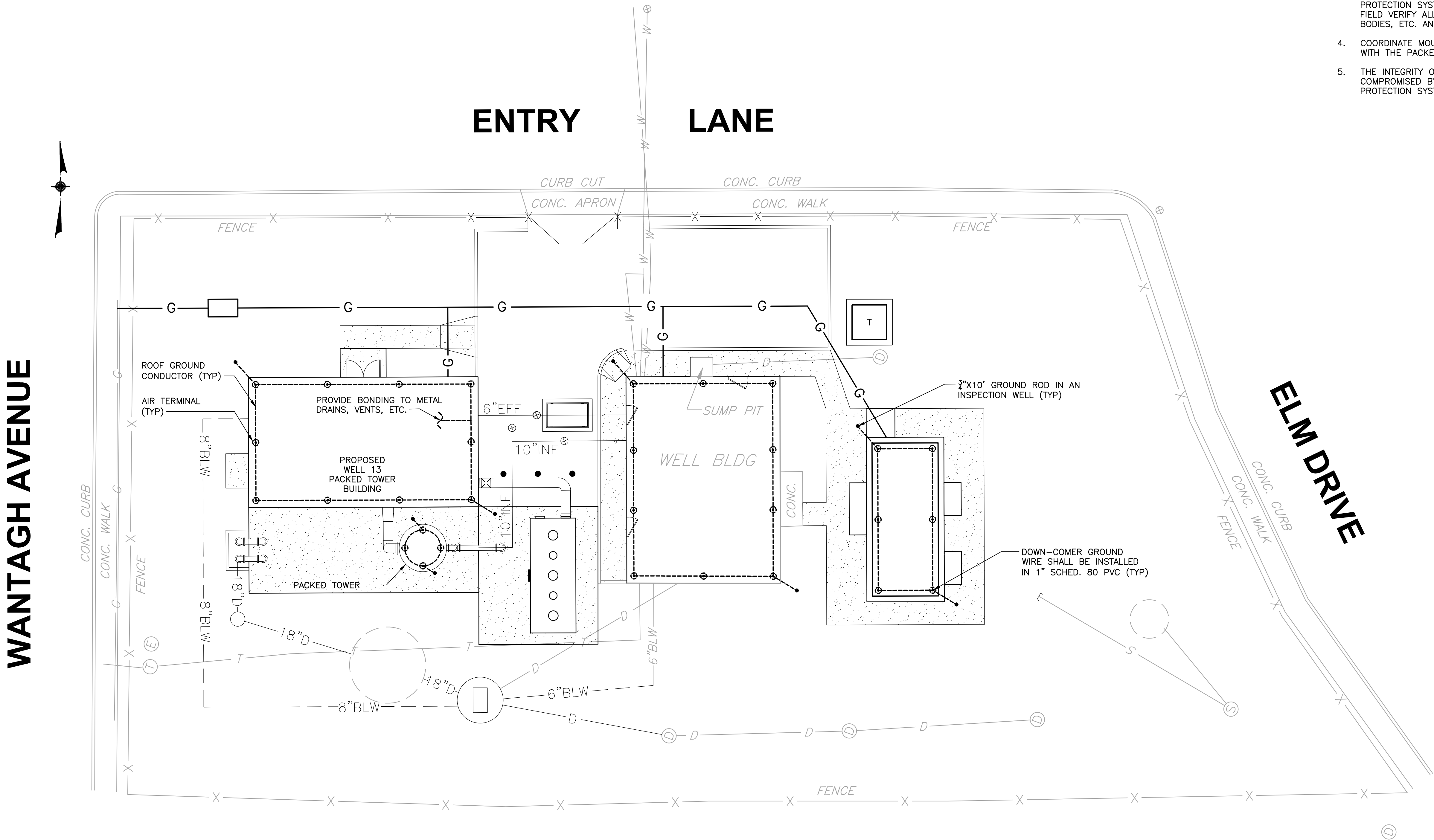
DATE:
NOVEMBER 2014



SCALE:
N.T.S.

DRAWING NO.
E14

NOTES:

1. REFER TO DWG G1 FOR SYMBOL LIST AND ABBREVIATIONS.
2. REFER TO SPECIFICATION SECTION 16770 FOR LIGHTNING PROTECTION REQUIREMENTS.
3. ALL METAL BODIES SHALL BE BONDED TO THE LIGHTNING PROTECTION SYSTEM IN ACCORDANCE WITH NFPA REQUIREMENTS. FIELD VERIFY ALL EXISTING ROOF MOUNTED EQUIPMENT, METAL BODIES, ETC. AND BOND AS REQUIRED.
4. COORDINATE MOUNTING OF AIR TERMINALS ON PACKED TOWERS WITH THE PACKED TOWER MANUFACTURER.
5. THE INTEGRITY OF THE ROOFING SYSTEMS SHALL NOT BE COMPROMISED BY THE INSTALLATION OF THE LIGHTNING PROTECTION SYSTEM.



					UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.		 D&B ENGINEERS AND ARCHITECTS, P.C. <small>KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS</small>	TOWN OF HEMPSTEAD DEPARTMENT OF WATER		LIGHTNING PROTECTION SYSTEM PLAN ELECTRICAL	PROJECT NO. 3402		E15	
					PROJECT ENGINEER: SL	DRAWN BY: JEZ		NASSAU COUNTY	NEW YORK		DATE: NOVEMBER 2014			
					DESIGNED BY: MN	CHECKED BY: WDM		LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13			SCALE: 1"=20'			
NO.	DATE	REVISION	INT.											



Town of Hempstead Department of Water Nassau County, New York

Notice and Instruction to Bidders, General Conditions, Wage Rates,
Special Conditional Specifications, Proposal, Town Forms, Supplementary
Conditions and Technical Specifications

Levittown Water District Construction of Packed Tower Aeration System at Well 13

PW No. PW 46-14 - General Construction
PW No. PW 47-14 - Electrical Construction
PW No. PW 48-14 - Plumbing Construction



D&B ENGINEERS
AND
ARCHITECTS, P.C.
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

**ADDENDUM NOTES AND MODIFICATIONS TO THE
TOWN OF HEMPSTEAD DEPARTMENT OF WATER
SPECIFICATIONS AND PLANS
IN CONJUNCTION WITH THE CONTRACT DOCUMENTS
FOR THE
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM AT WELL 13
GENERAL CONSTRUCTION CONTRACT NO. PW 46-14
PLUMBING CONSTRUCTION CONTRACT NO. PW 47-14
ELECTRICAL CONSTRUCTION CONTRACT NO. PW 48-14
ADDENDUM NO. 1
NOVEMBER 26, 2014**

Addendum No. 1 consisting of 1 page is hereby made part of the Contract Documents for Contracts No. PW 46-14, PW 47-14, and PW 48-14. Please note the following additions and changes to the Contract Documents, submit bids and be otherwise governed accordingly.

All page numbers noted are referenced to the project specification book unless otherwise noted. All drawing numbers are referenced to the drawing numbers of the Contract Drawings.

Acknowledgement or receipt of this addendum must be made by email or fax acknowledgement, and by signing the accompanying acknowledgement form and stapling to the bid pages.

I. Revisions and Additions to the Specification

- A. Replace the cover with the revised cover sheet demoting the correct contract numbers.

ADDENDUM NO. 1

Receipt Acknowledged

Bidders must acknowledge receipt of this addendum by signing below and returning via fax: (516) 364-9045 or email: slaun@db-eng.com, and stapling this page to the back of the Bid Sheets.

Bidder: _____
Legal Name of Person, Partnership, Joint Venture or Corporation

By: _____

Date: _____



Town of Hempstead Department of Water Nassau County, New York

Notice and Instruction to Bidders, General Conditions, Wage Rates,
Special Conditional Specifications, Proposal, Town Forms, Supplementary
Conditions and Technical Specifications

Levittown Water District Construction of Packed Tower Aeration System at Well 13

PW No. PW 46-14 - General Construction
PW No. PW 47-14 - Plumbing Construction
PW No. PW 48-14 - Electrical Construction



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**ADDENDUM NOTES AND MODIFICATIONS TO THE
TOWN OF HEMPSTEAD DEPARTMENT OF WATER
SPECIFICATIONS AND PLANS
IN CONJUNCTION WITH THE CONTRACT DOCUMENTS
FOR THE
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM AT WELL 13
GENERAL CONSTRUCTION CONTRACT NO. PW 46-14
PLUMBING CONSTRUCTION CONTRACT NO. PW 47-14
ELECTRICAL CONSTRUCTION CONTRACT NO. PW 48-14
ADDENDUM NO. 2
DECEMBER 9, 2014**

Addendum No. 2 consisting of 5 pages is hereby made part of the Contract Documents for Contracts No. PW 46-14, PW 47-14, and PW 48-14. Please note the following additions and changes to the Contract Documents, submit bids and be otherwise governed accordingly.

All page numbers noted are referenced to the project specification book unless otherwise noted. All drawing numbers are referenced to the drawing numbers of the Contract Drawings.

Acknowledgement or receipt of this addendum must be made by email or fax acknowledgement, and by signing the accompanying acknowledgement form and stapling to the bid pages.

I. Revisions and Additions to the Specifications

- A. Section 7, page 7-4, add the following to the end of SC 4.0: "The Engineer will be responsible for returning all submittals within 14 calendar days of receipt from Contractor. The Engineer will be responsible for performing milestone inspections and issuing approval or a list of outstanding items within 7 calendar days of receipt of notice from Contractor. The Engineer will be responsible for issuing a punch list within 14 calendar days of receipt of notice from Contractor."
- B. Section 16200, page 16200-1, Part 1.1.A.3 – revise, "...460/277 volts, 3 phase, 4 wire, no equal." To "...460/277 volts, 3 phase, 4 wire, or approved equal."
- C. Section 18300, page 18300-4, Part 2.1.D – revise, "...the design wind load shall be negligible, as the tower shall be housed within

a masonry structure" to "...the design wind load shall not be less than 221 lb/ft."

- D. Section 18600, page 18600-6, Part 2.6.B – revise, "The activated carbon shall be virgin, granular and manufactured from coconut by a domestic (United States) manufacturing facility." To "The activated carbon shall be virgin, granular and manufactured from coconut."
- E. Section 18600, page 18600-7, Part 3.2.A – delete in its entirety and replace with the following: "The carbon adsorption box shall be delivered to the site filled with approximately 12,000 pounds of virgin vapor phase granular activated carbon."
- F. Section 18600, page 18600-7, Part 3.2.B – delete in its entirety and replace with the following: "For replacement of carbon, loading shall be accomplished by gravity loading from bulk storage bags utilizing a mechanical lift. Gravity shall be the motive force for loading of fresh carbon and vacuum shall be the motive force for unloading of exhausted carbon."
- G. Section 18600, page 18600-7, Part 3.2.D – delete in its entirety.

II. Revisions and Additions to the Drawings

- A. Drawing G3, Site Details I: Revise "6'-0" x 4'-0" H-20 Rated Aluminum Double Leaf Access Door..." to "7'-0" x 4'-0" H-20 Rated Aluminum Double Leaf Access Door..."
- B. Drawing S4, Packed Tower Building Roof Framing Plan, Sections and Details: Refer to attached drawing for revisions to the packed tower aeration building roof plan and the addition of a roof hatch above the booster pump.
- C. Drawing S5, Packed Tower Building Details: Refer to attached drawing for addition of roof hatch details.
- D. Drawing E4, Proposed Site Plan: The correct scale is 1"=10'.
- E. Drawing E9, Motor Control Centers MCC-W and MCC-PT Single Line Diagrams: Revise "F2" to "P1".
- F. Drawing E11, Control System Riser Diagrams: Revise "13250" to "18400" and revise "13600" to "18500".

ADDENDUM NO. 2

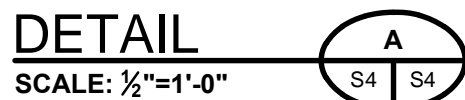
Receipt Acknowledged

Bidders must acknowledge receipt of this addendum by signing below and returning via fax: (516) 364-9045 or email: slaun@db-eng.com, and stapling this page to the back of the Bid Sheets.

Bidder: _____
Legal Name of Person, Partnership, Joint Venture or Corporation

By: _____

Date: _____



PROJECT ENGINEER: SL	DRAWN BY: JEZ
DESIGNED BY: NN	CHECKED BY: WDM

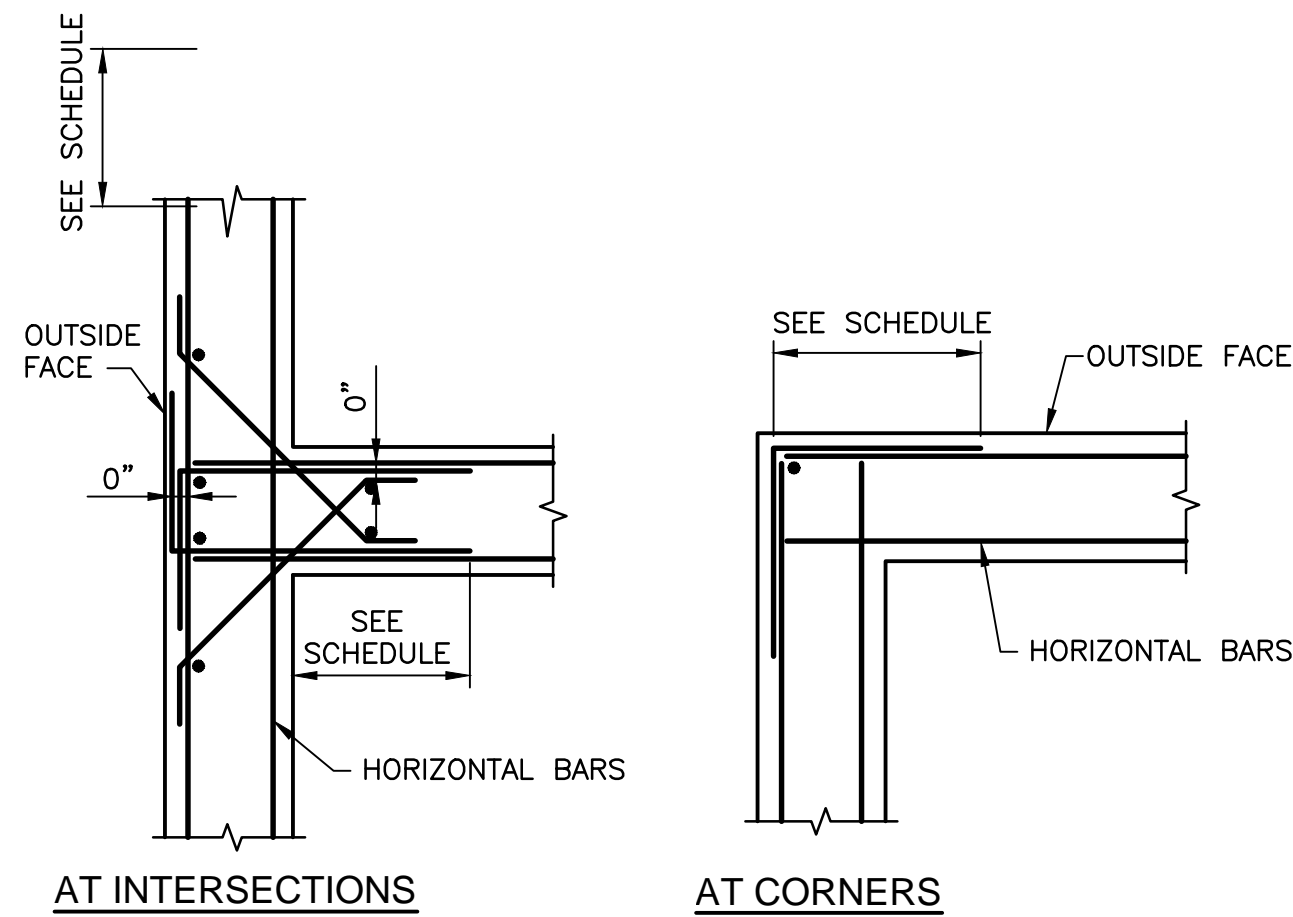


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KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

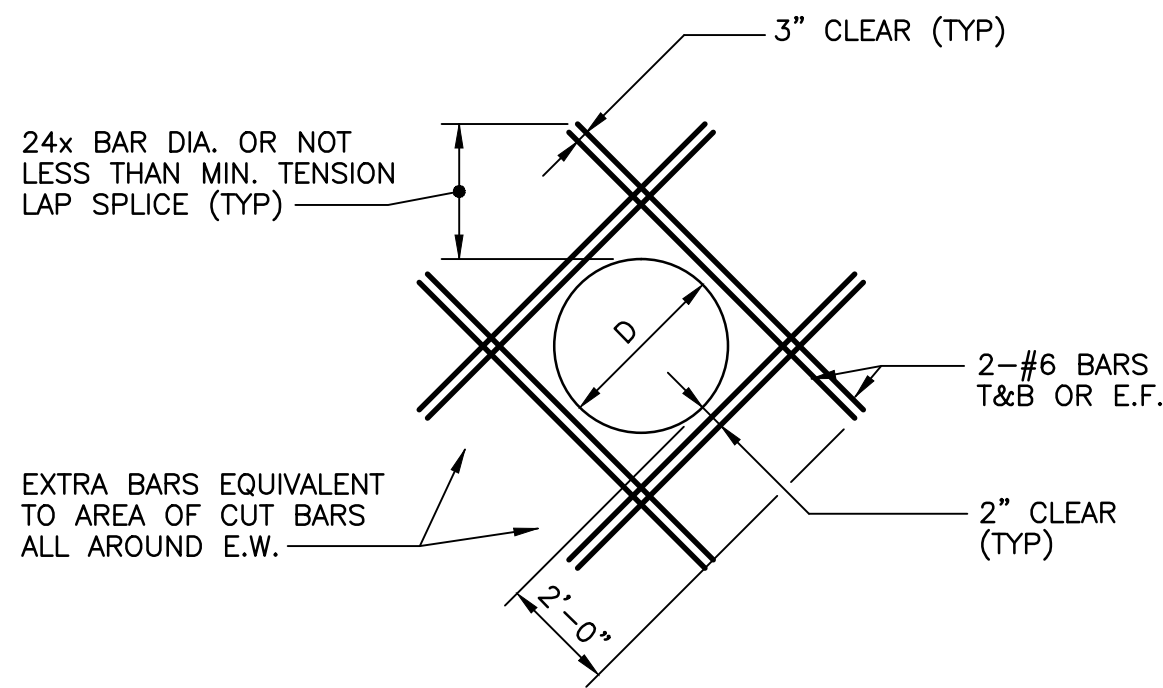
NASSAU COUNTY	NEW YORK
<p align="center">LEVITTOWN WATER DISTRICT CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13</p>	

PACKED TOWER BUILDING
ROOF FRAMING PLAN, SECTIONS AND DETAILS
STRUCTURAL

PROJECT NO. 3402	DRAWING NO. S4
DATE: NOVEMBER 2014	
SCALE: AS SHOWN	

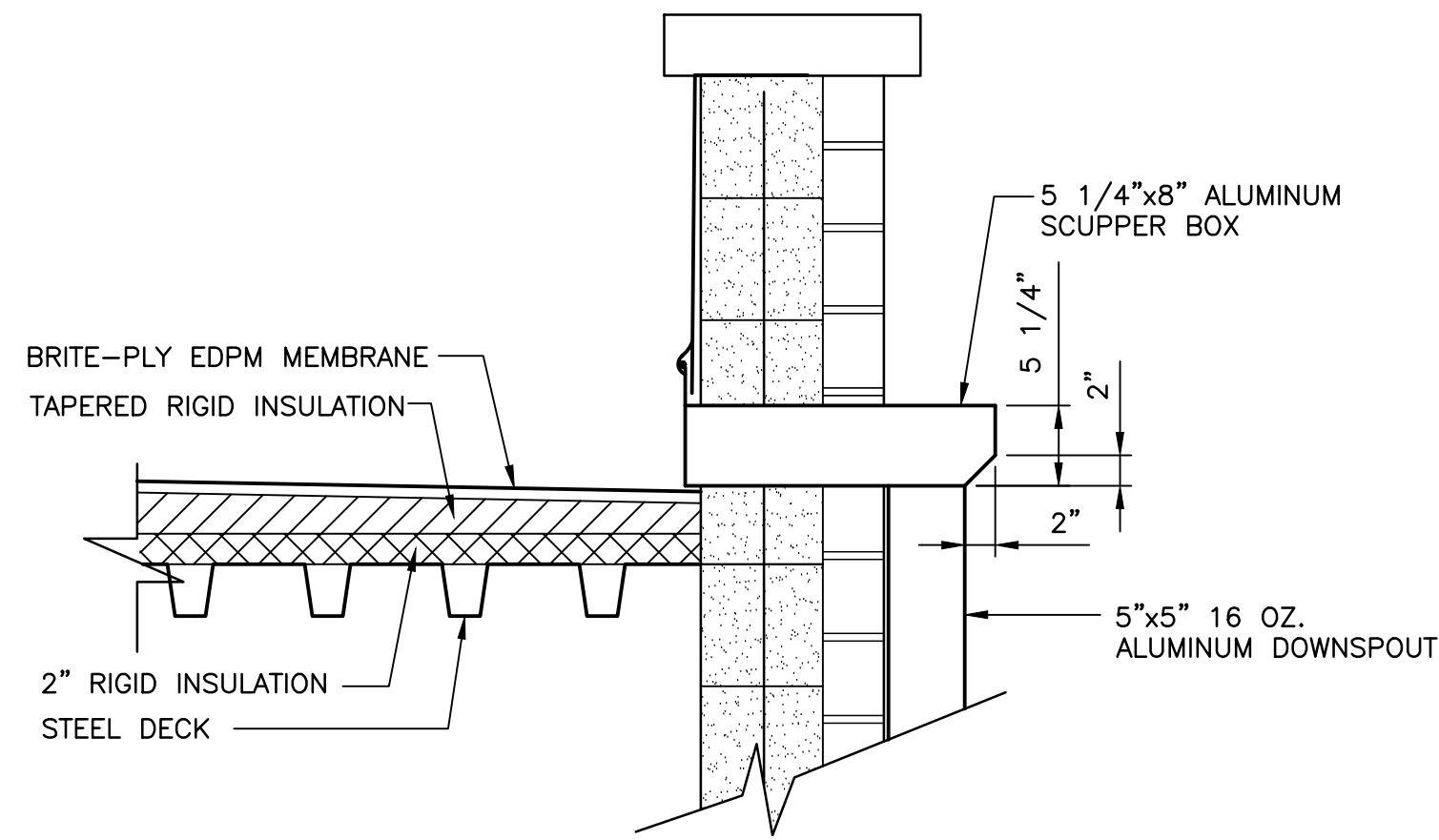


PLAN OF HORIZONTAL REINFORCING OF CONCRETE WALLS
N.T.S.



ADDITIONAL REINFORCEMENT FOR CIRCULAR OPENINGS DETAIL
N.T.S.

NOTE: TYPICAL FOR OPENINGS IN ALL CONCRETE SLABS AND WALLS (UNLESS NOTED)

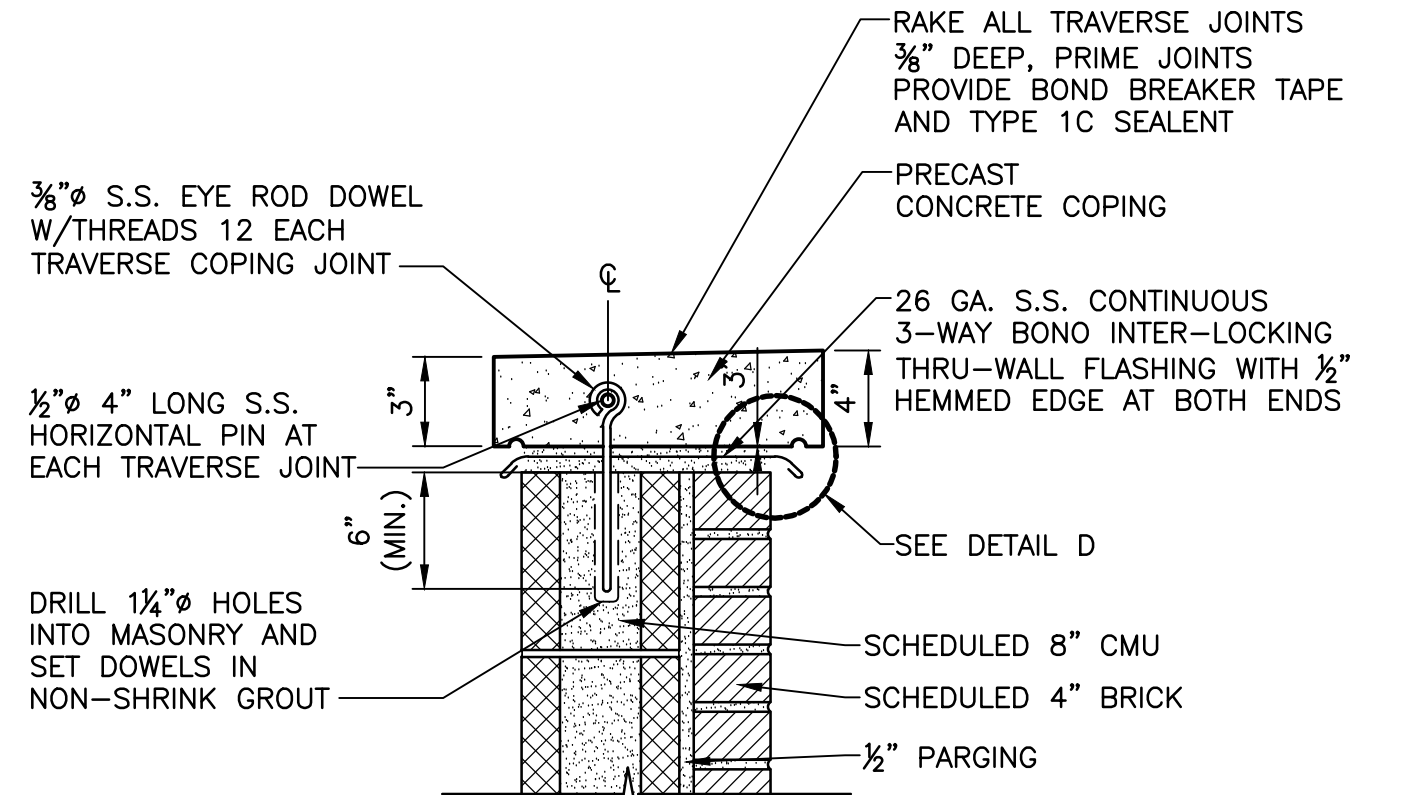
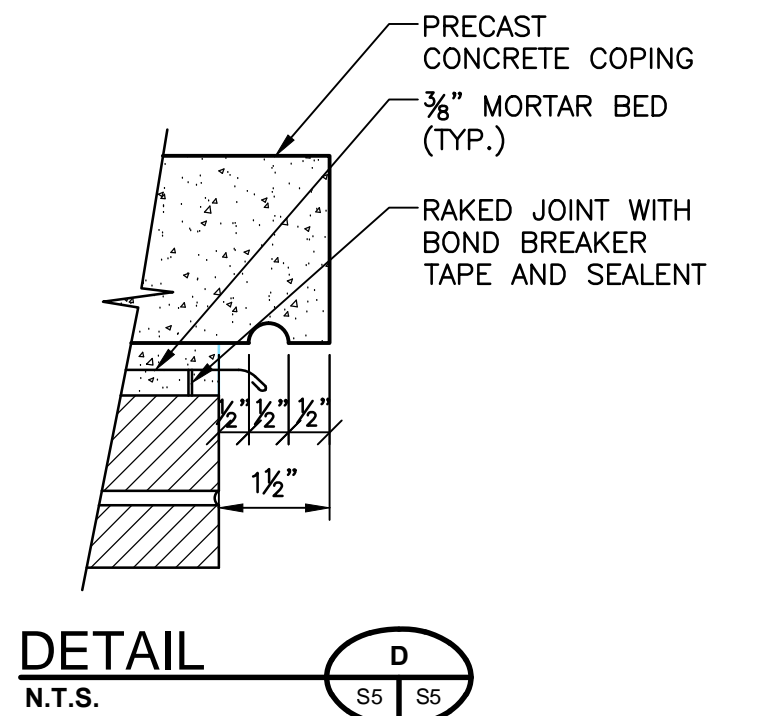


NOTES:

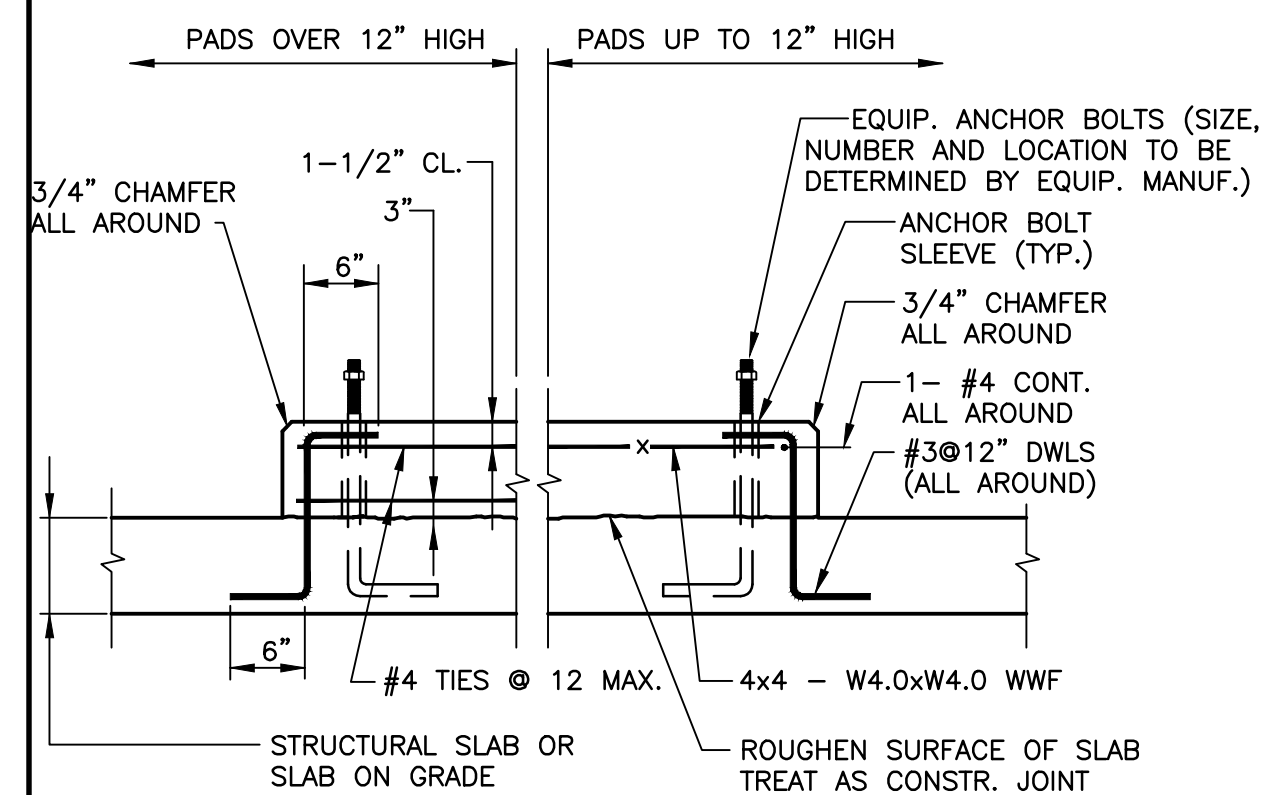
1. ALUMINUM FLASHING COLOR CHART SHALL BE SUBMITTED TO OWNER FOR COLOR SELECTION.
2. SEE DWG. NO. S4 FOR ADDITIONAL STRUCTURAL DETAILS OF PARAPET AND ROOF FRAMING.

METAL SCUPPER

DETAIL C
SCALE: 1"=1'-0"

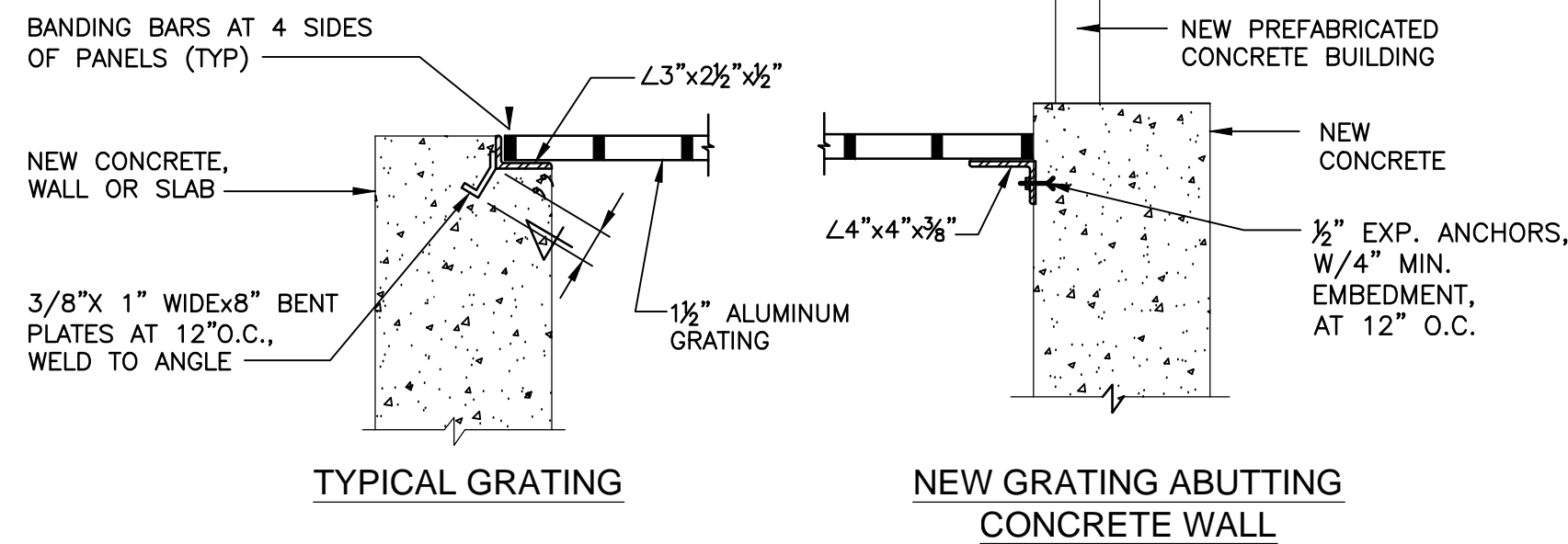


COPING STONE DETAIL
N.T.S.

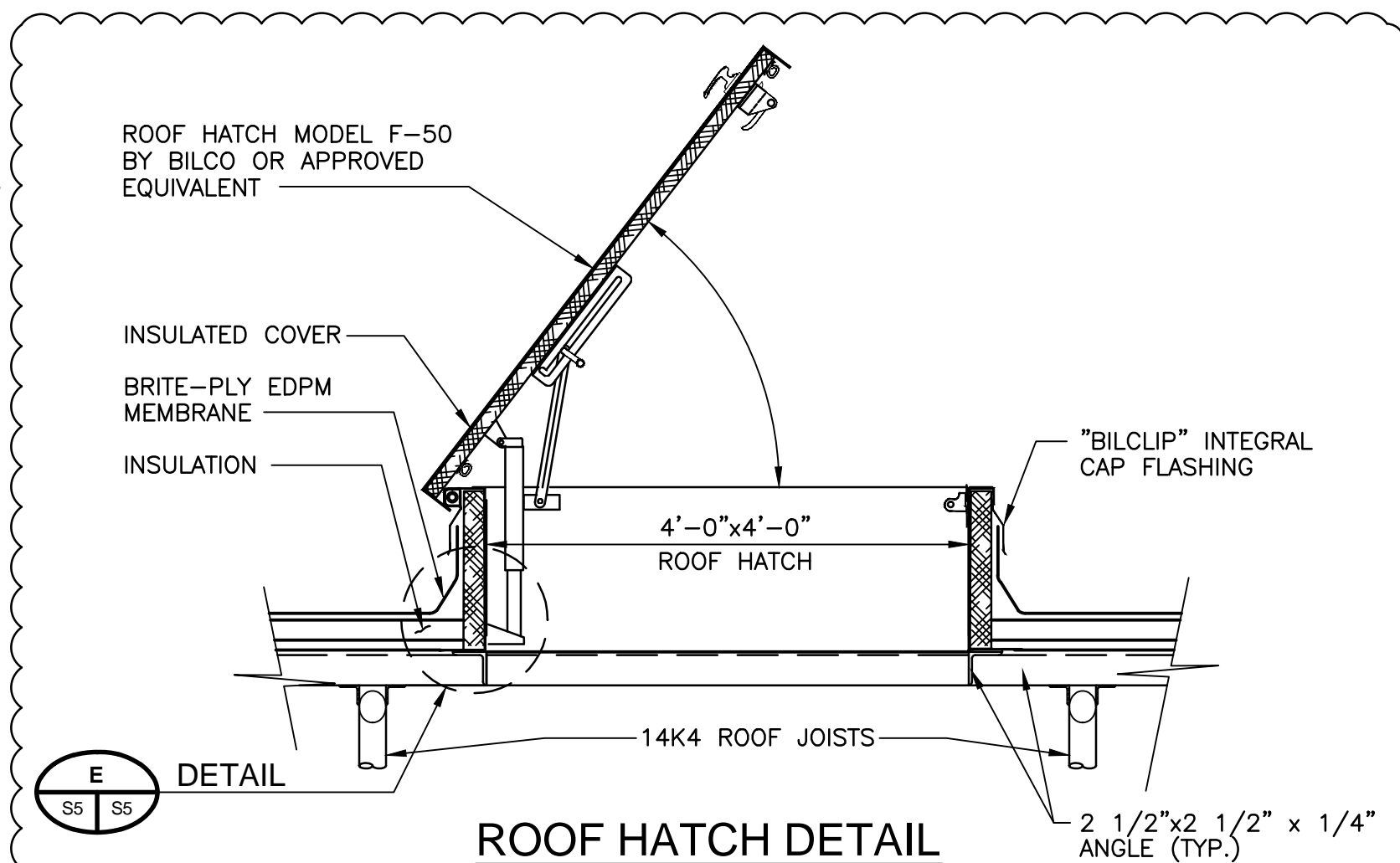


EQUIPMENT PAD DETAIL
N.T.S.

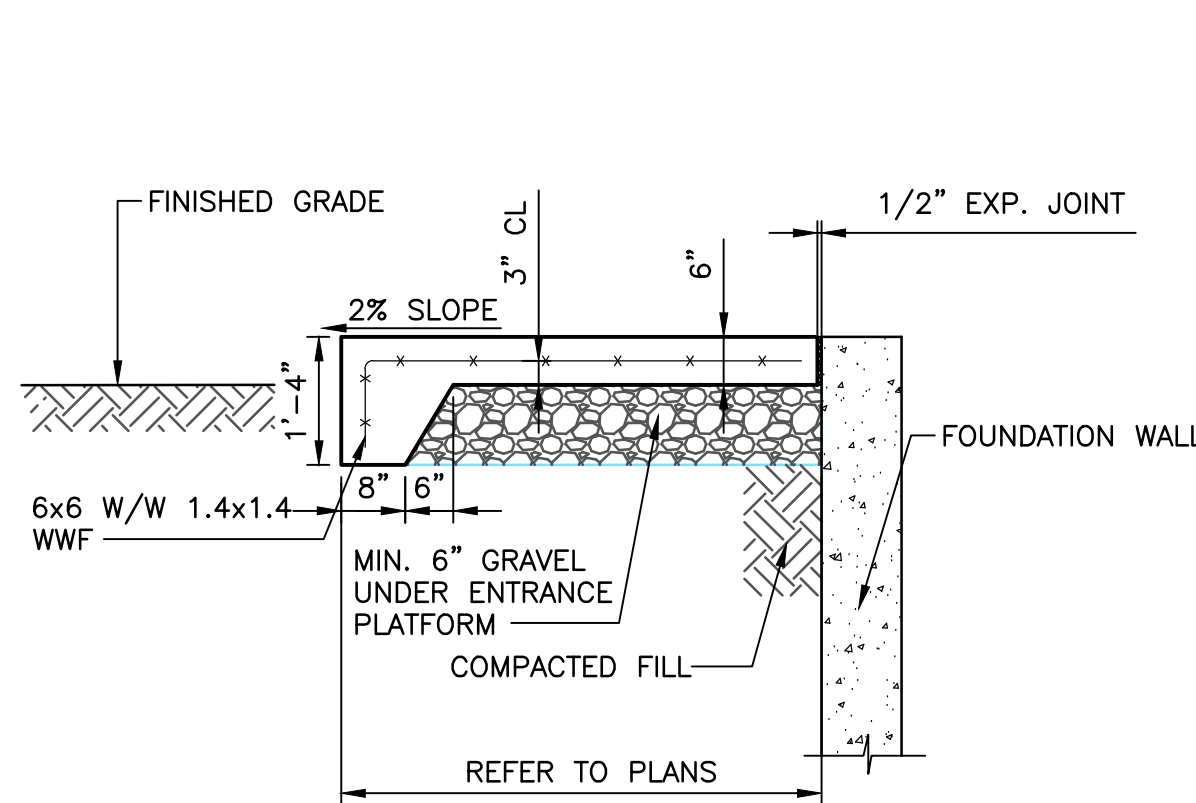
THE EXACT SIZE, SHAPE, AND LOCATIONS OF ALL EQUIPMENT (HOUSEKEEPING) PADS SHALL BE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER, FOLLOWING THE APPROVAL OF



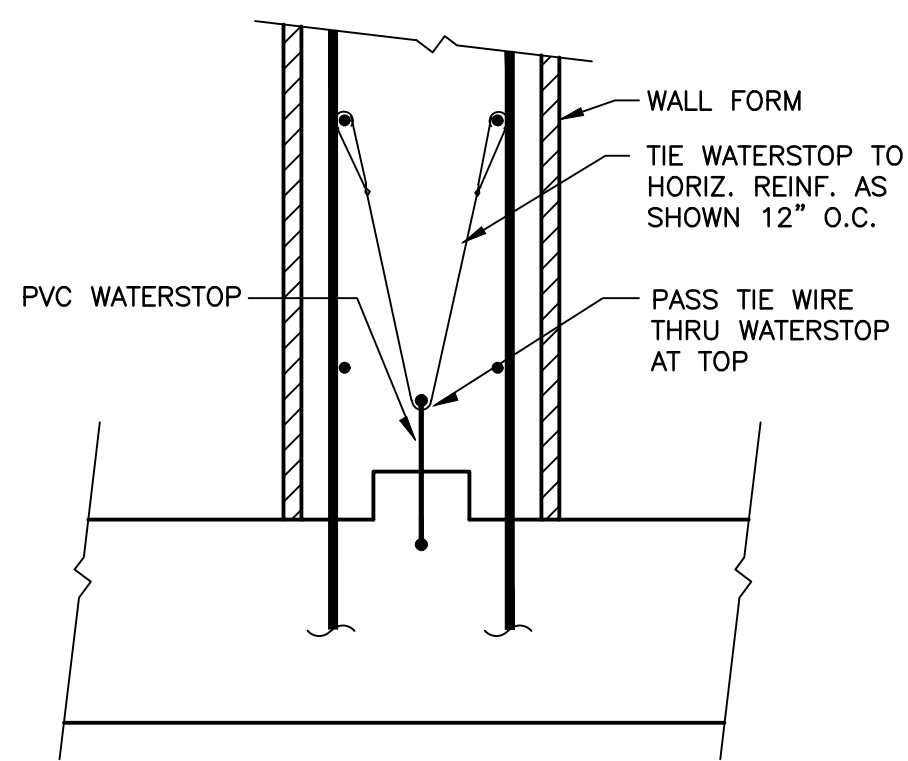
DETAIL B
N.T.S.



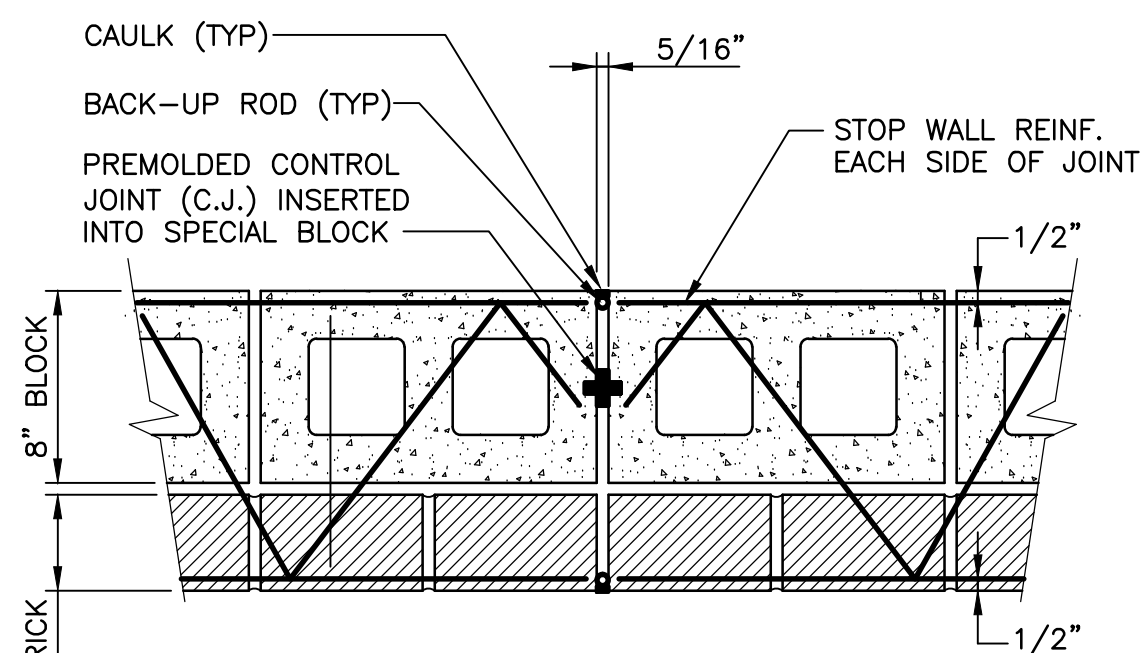
ROOF HATCH DETAIL
SCALE: 1"=1'-0"



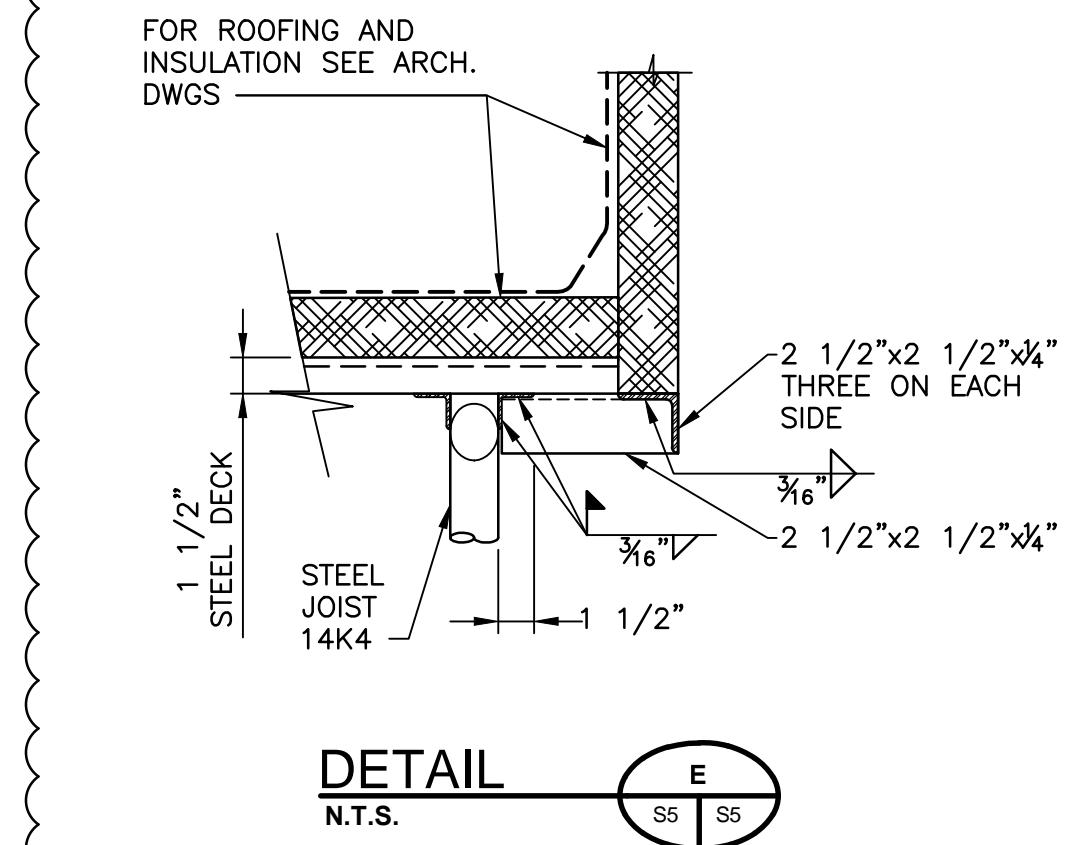
CONCRETE PAD DETAIL
N.T.S.



PVC WATERSTOP INSTALLATION DETAIL
N.T.S.



DETAIL OF CONTROL JOINT IN MASONRY WALL
N.T.S.



Reinf. Splice and Development Length (in inches, for Epoxy coated bars) (unless otherwise shown on drawings)										
For slabs, and walls 12.2.3										
BAR SIZE	#3	#4	#5	#6	#7	#8	#9	#10	#11	
SPLICE LENGTH	19	25	32	38	55	63	78	97	116	
OTHER BARS	17	22	28	34	49	56	69	85	102	
DEVELOPMENT LENGTH	15	20	24	29	43	49	60	74	89	
OTHER BARS	13	17	22	26	38	43	53	66	79	

Table values apply for the following conditions:

1. Normal weight concrete with $f_c = 4000$ psi @ 28 days
2. ASTM A615 Grade 60 Epoxy coated deformed steel reinforcing bars
3. Concrete cover min 2", and clear spacing between bars min. 4x bar diameter (incl. splices)
4. Top' bars are defined as horizontal bars with more than 12" of concrete cast in the member below the bars.
5. All wall bars are classified as 'Other bars'
6. Unless otherwise approved or shown on the drawings all splices shall be staggered such that not more than 50% of bars are spliced at any location.

Reinf. Splice and Development Length (in inches, for Epoxy coated bars) (unless otherwise shown on drawings)										
For beams w/ stirrups 12.2.2										
BAR SIZE	#3	#4	#5	#6	#7	#8	#9	#10	#11	
SPLICE LENGTH	32	42	53	63	92	105	119	133	148	
OTHER BARS	28	37	47	56	81	93	105	118	131	
DEVELOPMENT LENGTH	24	33	41	49	71	81	91	103	114	
OTHER BARS	22	29	36	43	63	71	81	91	101	

Table values apply for the following conditions:

1. Normal weight concrete with $f_c = 4000$ psi @ 28 days
2. ASTM A615 Grade 60 Epoxy coated deformed steel reinforcing bars
3. Concrete cover min 2", and clear spacing between bars min. 4x bar diameter (incl. splices)
4. Top' bars are defined as horizontal bars with more than 12" of concrete cast in the member below the bars.
5. All wall bars are classified as 'Other bars'
6. Unless otherwise approved or shown on the drawings all splices shall be staggered such that not more than 50% of bars are spliced at any location.

SPLICING DEVELOPMENT SCHEDULE
N.T.S.

NO.	DATE	REVISION	INT.
12/8/14	ADDENDUM #2 WELL 13		S.L.



UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF SECTION 7209 OF THE NEW YORK STATE EDUCATION LAW.			
PROJECT ENGINEER:		DRAWN BY:	
SL		JEZ	
DESIGNED BY:		CHECKED BY:	
NN		WDM	



TOWN OF HEMPSTEAD DEPARTMENT OF WATER	
NASSAU COUNTY	NEW YORK
LEVITTOWN WATER DISTRICT	
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM FOR WELL 13	

**PACKED TOWER BUILDING
DETAILS
STRUCTURAL**

PROJECT NO. 3402	DRAWING NO. S5
DATE: NOVEMBER 2014	
SCALE: AS SHOWN	

**ADDENDUM NOTES AND MODIFICATIONS TO THE
TOWN OF HEMPSTEAD DEPARTMENT OF WATER
SPECIFICATIONS AND PLANS
IN CONJUNCTION WITH THE CONTRACT DOCUMENTS
FOR THE
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM AT WELL 13
GENERAL CONSTRUCTION CONTRACT NO. PW 46-14
PLUMBING CONSTRUCTION CONTRACT NO. PW 47-14
ELECTRICAL CONSTRUCTION CONTRACT NO. PW 48-14
ADDENDUM NO. 3
DECEMBER 11, 2014**

Addendum No. 3 consisting of 5 pages is hereby made part of the Contract Documents for Contracts No. PW 46-14, PW 47-14, and PW 48-14. Please note the following additions and changes to the Contract Documents, submit bids and be otherwise governed accordingly.

All page numbers noted are referenced to the project specification book unless otherwise noted. All drawing numbers are referenced to the drawing numbers of the Contract Drawings.

Acknowledgement or receipt of this addendum must be made by email or fax acknowledgement, and by signing the accompanying acknowledgement form and stapling to the bid pages.

I. Revisions and Additions to the Specifications

- A. Section 5 Proposal, remove pages 5-8 and 5-9 in their entirety and replace with the attached pages 5-8 and 5-9.
- B. Section 01020, page 01020-1, add the following after Part 1.1.J:
"K. Plumbing Construction Bid Item No. 5: An allowance of \$10,000 for natural gas service work provided by National Grid."
- C. Section 01020, page 01020-2, Part 1.2.D – revise, "...under the Allowance for Plumbing Construction Bid Item No. 4 will be..." to "...under the Allowance for Plumbing Construction Bid Item No. 5 will be...".
- D. Section 18600, page 18600-2, Part 1.4.B – delete in its entirety.

II. Revisions and Additions to the Drawings

- A. Drawing M5, Well 13 Building Existing and Proposed Floor Plans: Revise "Remove Diesel Engine and Appurtenances As Indicated" to "General Contractor Shall Remove Diesel Engine and Appurtenances As Indicated".
- B. Drawing M7, Packed Tower Building Details II: Revise "New Concrete Pump Pier" to "New Concrete Pump Pier. General Contractor Shall Complete All Concrete Work Associated With The New Concrete Pump Pier".
- C. Drawing E5, Well 13 Building Floor Plan: All 3" Concrete Pads called out on the Drawing are to be provided by the General Contractor.
- D. Drawing E4, Proposed Site Plan: Revise "Natural Gas Service By General Contractor" to "Natural Gas Service By Plumbing Contractor".

ADDENDUM NO. 3

Receipt Acknowledged

Bidders must acknowledge receipt of this addendum by signing below and returning via fax: (516) 364-9045 or email: slaun@db-eng.com, and stapling this page to the back of the Bid Sheets.

Bidder: _____
Legal Name of Person, Partnership, Joint Venture or Corporation

By: _____

Date: _____

Name of Bidder _____

BIDDER'S PROPOSAL
LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM AT WELL 13
PLUMBING CONSTRUCTION CONTRACT NO. PW 47-14

Bidder agrees to perform all work described in Bid Documents for the prices named in the following schedule:

Item	Unit of Measure	Estimated Quantity	Description	Unit Price Bid in		Total Price
				Both Words and Figures	dollars and cents	Bid in Figures
1	Lump Sum	--	Furnishing all labor, materials, equipment and appurtenances to complete all work described under Plumbing Construction Contract No. PW 47-14 in the Contract Documents.			\$ _____
2	Lump Sum	--	Allowance for SCADA system additions.	Eighty-five thousand and no	dollars cents	\$85,000.00
3	Lump Sum	--	Allowance for providing additional work at the site as directed by the Owner.	Thirty thousand and no	dollars cents	\$30,000.00
4	Lump Sum	--	Allowance for incentive assessment.	Thirty thousand and no	dollars cents	\$30,000.00
5	Lump Sum	--	Allowance for natural gas service work provided by National Grid.	Ten thousand and no	dollars cents	\$10,000.00

TOTAL AMOUNT OF BID ITEMS 1 THRU 5

IN FIGURES \$ _____

IN WORDS \$ _____

Name of Bidder

BIDDER'S PROPOSAL

**LEVITTOWN WATER DISTRICT
CONSTRUCTION OF PACKED TOWER AERATION SYSTEM AT WELL 13
PLUMBING CONSTRUCTION CONTRACT NO. PW 47-14**

The Bidder proposes to use the following equipment manufacturers for the following principal items of equipment to be used in the Work to wit:

<u>Equipment</u>	<u>Reference to Specification Section</u>	<u>Equipment Manufacturer Name and Address</u>
Packed Tower Aeration System	18300	
Off-Gas Treatment System	18800	
SCADA System	18420	

Bids will be compared on the basis of the total amount bid for Items 1 thru 5.

Where the price in figures differs from the price in words, the price in words will be accepted as the amount bid and amounts computed and adjusted accordingly.

Estimated quantities, where given, are approximate and are for the purpose of evaluating the proposals only.

The OWNER reserves the right to omit or add to the construction or any portion of portions of the work heretofore enumerated or shown on the plans without forfeiture of Contract or claims for loss of anticipated profits or any other claims by the BIDDER on account of such omissions or additions.